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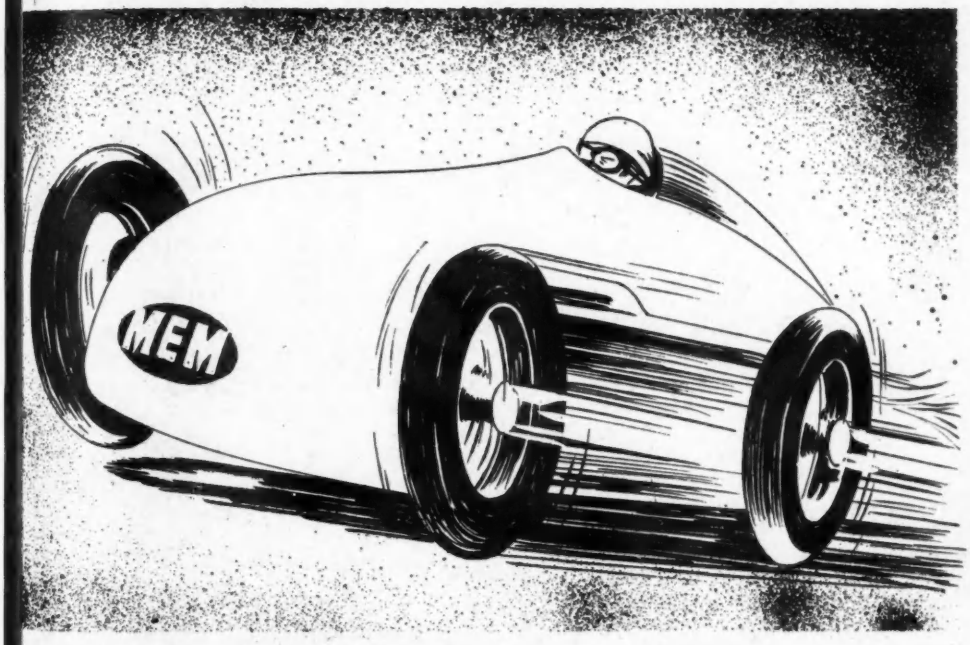

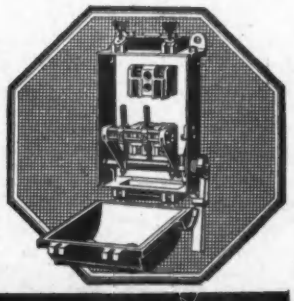

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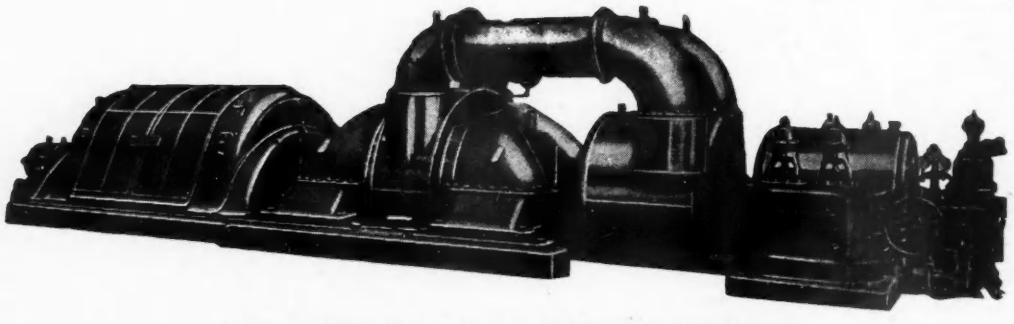

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The
Electrical Review

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Lightning Effects

THUNDERSTORMS seldom break over a large city like London without doing some damage, but, considering their exposed positions and mileage, our overhead transmission systems get off reasonably lightly. This relative freedom from serious trouble is largely to be attributed to the efficiency of our protective systems (although not even underground cables are immune from the indirect results of lightning, as appeared quite recently when Hammersmith Bridge was struck), but there still remains the question as to whether we arrange for minimising the effect of a stroke in the most satisfactory way.

A lightning flash usually consists of a number of discharges in rapid succession. Recent investigations seem to show that what we see is the return from earth to a cloud of the discharge by the ionised path formed in its downward journey, when it is normally invisible. The voltage to which a line is raised is proportional to the quantity of the charge and inversely to the capacity; 4,500 kV has been recorded for a direct stroke.

Induced effects are electrostatic, the electromagnetic influence being negligible, and the time of discharge varies from about five to forty millionths of a second. One of the results of the high frequency of the current from a flash (the value of which depends upon cloud sizes and heights, and may be as much as 200,000 A) is that it tends to jump bends rather than to follow the path with the greater conductance.

When a line is struck the charge, unless dissipated by flashing over at the insulators, may damage associated apparatus at a terminal station; in our issue of May 11th Mr. J. M. Goodall drew attention to the dangers of over-insulating the lines and showed the advantages of a "co-ordinating gap." Shortly after this, in the *Electrical World*, Mr. L. V. Bewley pointed out that the crest value of a steep-fronted wave travelling from the line was approximately doubled at the station and that this value might be greater than the flash-over value of the apparatus in circuit. He finds that there is a terminal zone that extends from the station for about three miles for very short waves and twelve or more miles for long waves. Within this zone surges below the flash-over value of the line insulation may originate and travel to the station.

If the line insulation is raised the limit of the zone is extended and the terminal apparatus is subjected to a greater number of surges exceeding its flash-over value. With short lines the entire length may be brought into the terminal zone and most of the effect will be felt at the station. On the other hand, if modern lightning arrestors are installed at the station he considers the better line insulation will decrease the total system failures.

This is not altogether in accordance with the views of many British engineers, but current research will, we believe, decide the methods that best meet conditions in this country.

The cardinal principle that protective gear is installed primarily to protect the systems and not individual pieces of apparatus still holds good, but there is also an important secondary rule that the most expensive apparatus should receive first consideration.

Distribution Policy

FOLLOWING almost immediately upon our leading article of last week upon British electricity supply policy, and the publicity that some sections of the political Press have been giving to "secret talks" and revolutionary proposals, we note an article prominently placed in the *Times* of Tuesday which is obviously based upon official statements made to it by representatives of the Commissioners and of the Board respectively. One is inclined to wonder whether, if the publicity arrangements of these two authorities worked effectively, political rumours and suggestions and sensational prophecies of this kind would not lose much of their interest. Neither the general Press nor the general public can be expected to have the same knowledge of the developing electrical situation as those closely connected with it; we are afraid that this very ordinary fact is lost sight of owing to the preoccupa-

tion with the policy problem itself. The *Times* article, imposing as it may at first sight appear, tells its readers little, if anything, more than is already known to electrical men. The report on distribution which was presented to the Commission after a joint conference of representatives of local authorities and private companies is now under review, and its recommendations are being studied. No definite decisions have yet been reached; when they are they will be communicated to the Minister of Transport. It is stated that while any suggestions that may be made to him for reorganisation of distribution may involve fresh legislation, this will depend upon the character of the proposals that are advanced and the willingness or otherwise of certain classes of undertakings to amalgamate, if that course be recommended. Of course, ways and means already exist for a certain amount of reorganisation to take place voluntarily with the Commission's concurrence. If these prove insufficient to secure the desired end—and some of our readers may easily conceive of such a state of things—new legislation may be the only way out in the national interest.

Iron as an Insulator

Insulating properties are relative, and the reactive effect of an iron sheath when surrounding an insulated wire carrying a.c. and an uninsulated return may be such as to make it function as a virtual insulator. Leakage current varies with frequency, current in the insulated lead, thickness and length of the wire sheath and its shape, dimensions and composition. Under the conditions described by Mr. B. S. Hornby in this issue the leakage may be so small a fraction of the total amperage as to be negligible for practical purposes.

The Approach of Darkness

August ends to-day, and our thoughts are turned towards the coming autumn and winter by the lamp manufacturers, who at this time of the year commence their campaign for more light. The subject demands special treatment: brightness must be the keynote and colour must play an important part. In this the manufacturers have not failed; the examples which we are now receiving (some of which are dealt with on another page) show that this season's publicity material is better than ever. New and ingenious ideas are embodied in it, and designs of former years with which the public have become familiar appear in new guises. It cannot be gainsaid that the general average of illumination is still far from adequate—in fact, deplorably low—so that there can be no doubt that an extensive and profitable market is open to sellers of light.

Frequency Change-overs

Some idea of the work involved in frequency standardisation may be gained from the records of a large undertaking like that of Birmingham Corporation, which is changing over its e.h.v. distribution system from 25 cycles 5 kV to 50 cycles 11 kV. During one week of this month 16,190 h.p. of machinery and 11,239 kVA (sixty-eight sets) of transformers, with their associated switchgear, were changed on the premises of twenty-eight e.h.v. consumers. That alterations of this character are being carried out in various parts of the country without loss or undue disturbance to consumers reflects most creditably on the *ad hoc* organisations set up by supply undertakings. Several of the engineers employed on this work have recorded their experiences in our columns, and their readiness to assist others similarly engaged has, no doubt, contributed largely to the success of the schemes as a whole.

Electricity Ad Lib.

A few months ago we recorded the fact that an American electricity supply company—the San Joaquin Light and Power Corporation—had decided to permit its domestic and commercial lighting consumers to use as much electricity as they liked during May and June at a charge for each month which would not exceed that for March. Agricultural customers were to be charged half the ordinary rate for energy consumed in excess of the March amount. At the time this offer was considered to savour of lunacy, but the results showed it to be thoroughly worth while. The principal idea behind the scheme was to introduce a two-part plan, and was intended to show whether revenue could be maintained in the face of reduced rates. There was naturally a big jump in consumption, and just as naturally a decline when the period ended—but the general level was raised considerably, and it is expected that the rate of normal increase will be accelerated. Apart from the effect on the supply company's system, the offer induced consumers to purchase all kinds of new apparatus, thus benefiting the manufacturers and dealers. Some of our own wealthy supply authorities might secure interesting results from such a departure. Will any of them try it?

Planned Systems

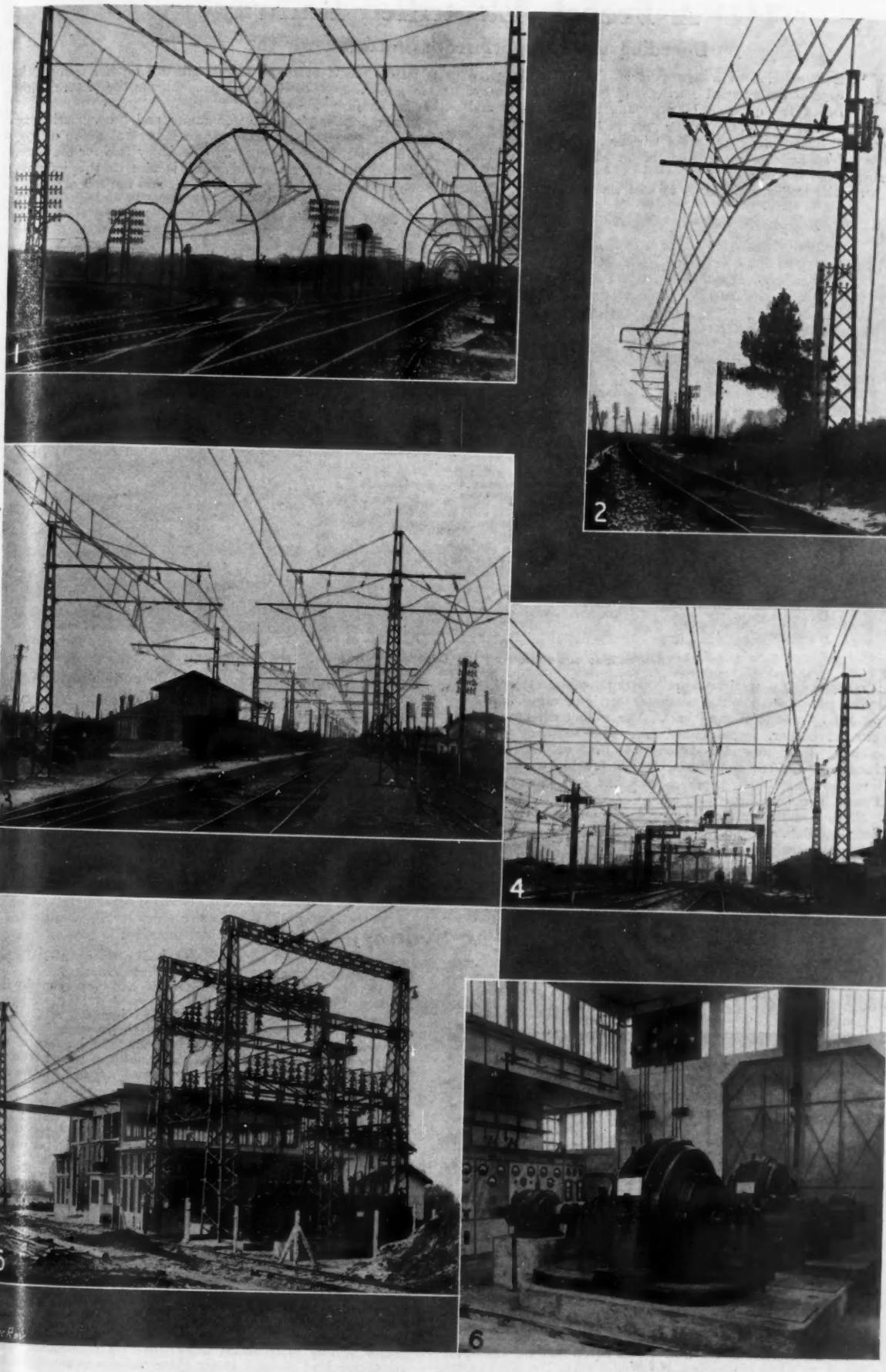
Bulgaria, France and Japan have been added to the list of countries that are going in for nationally planned electrification schemes. South Africa claims to be the first to have put such a scheme into commission, but our own grid was the first to be "tight-coupled" (by linking the bus-bars of selected stations); interconnecting systems that have developed as the demand arose have tended to be "loose-coupled" (by linking the e.h.v. distributors) and—like Topsy—have just "growed." That Great Britain should lead other nations in initiating a scheme that has been devised as a comprehensive whole seems a reversal of the usual reputed order of things; it is we who have been accused in the past of being content to "muddle through." The enhancement of our reputation abroad is indicated by the visit of American electrical engineers to study our grid, upon which we commented last week, as well as the appointment in the United States of a national power policy committee.

An Encouraging Start

The Electricity Board for Northern Ireland has powers similar to those of our Central Electricity Board, but, in addition, it can acquire undertakings and can construct new l.v. distribution systems. The report for 1933 has just been issued, but from what Mr. C. R. Westlake, the engineer and manager, tells us, an even more rapid progress this year than last makes the statistics already out of date. He expects fully 80 per cent. of the domestic consumers to be using electric cookers and heaters by the end of next year. The Board's development methods are based on newspaper advertising, E.D.A. literature, and personal calls. Canvassers are paid on a salary plus commission basis, the latter being higher for securing a two-part tariff consumer than for a flat-rate application, and still more for placing permanently a cooker or a water-heater. The annual revenue brought in by each canvasser averages £1,200. The secondary charge of the tariff drops to ½d. per kWh after a small number has been taken at ¾d. Few undertakings can have shown such encouraging progress in a period of less than two years.

An Old Question Unanswered

Comments in the daily Press on electricity tariffs are usually much better informed now than they were only two or three years ago. Instead of confining criticism to lighting flat rates, journalists tend to pay regard to the more important effects of high charges on consumers of electricity for heating, cooking, commercial lighting and industrial power. Due appreciation of these aspects was shown in a leading article that appeared in a London evening paper a few days ago, in which the query was raised as to why all undertakings did not permit their domestic consumers to enjoy the benefits of "all-in" tariffs. The writer of the editorial also could not understand why residents on one side of a London street have to pay more for electricity than those on the other. Neither can we.



The Bordeaux-Pointe de Grave Railway described on page 270

1. The junction of the Pointe de Grave line and the Bordeaux circular railway. 2. Showing the method of suspending the contact conductors. 3. The Margaux station. 4. The Bordeaux yard. 5. The Blanquefort sub-station. 6. The interior of the Blanquefort sub-station

A French Electrified Railway

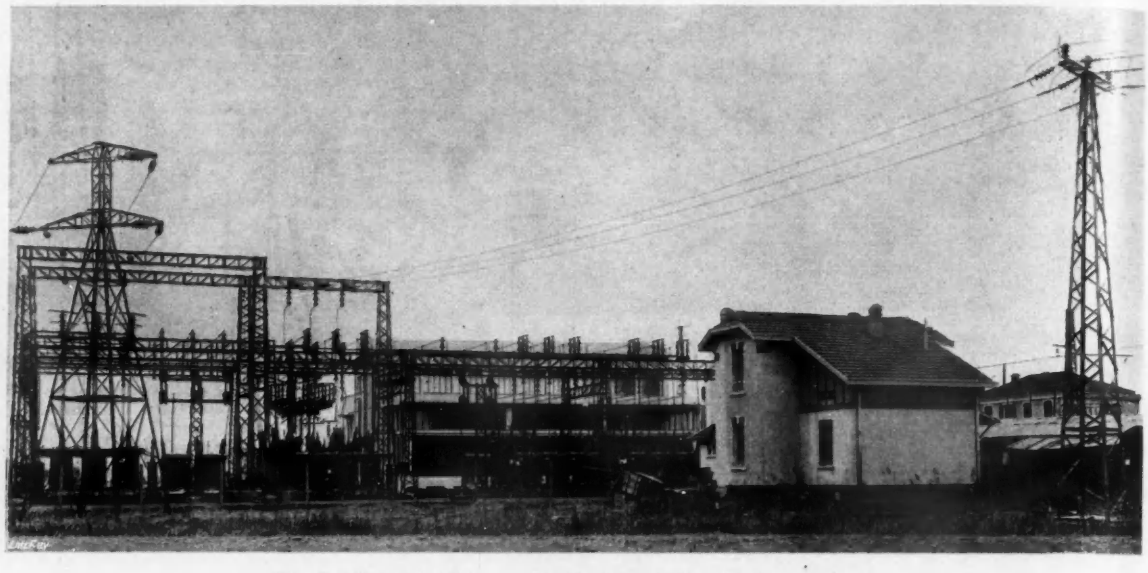
Speeding up transport from Bordeaux to the sea

THE completion of a new port at Pointe de Grave, a cape at the seaward extremity of the Gironne estuary, raised the question of providing for the quick and easy transport of goods from the port to Bordeaux, which is nearly 60 miles inland along the Gironne. The problem has been solved by the construction of an electric railway line between the two places.

An aerial trolley wire serves to feed the locomotives. This is composed of a steel or copper carrying cable, supported on metal pylons from which auxiliary carrying cables are suspended by means of rigid bars. The trolley wire proper, in grooved copper, is suspended from the auxiliary carrying cables. Five new sub-stations at Blanquefort, Labarde, Pauillac, Lesparre and Soulac which provide power to the line receive 60,000-V supplies from the step-down plant at Pessac, and transform it to 1,500-V d.c.

The sub-stations are of similiar design and comprise an outdoor installation at h.p., and a building in which are the motor convertors for the d.c. The outdoor portion is composed of a steel framework on which are installed the 60,000-V cut-outs and section switches. Also, the connection from the 60,000-V line is overhead and terminates on the framework. The general appearance can be gauged from the picture below of the Pauillac sub-station.

In the building are the generators and other machinery, including the charging plant for an important group of storage batteries, which serve as an emergency feed for the signal system. The l.p. d.c. switchboard is also in this building. There are convertors for each station, and are fed at 1,500 V a.c. from the transformers placed in the outside portion of the station. They have a capacity of 750 kW each.



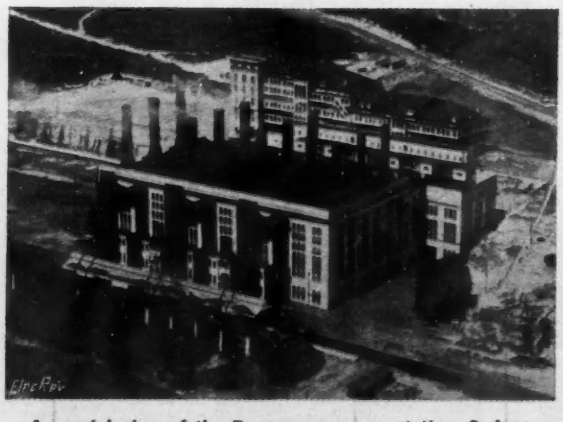
The Pauillac sub-station on the Bordeaux-Pointe de Grave railway

The transformers are of the outdoor type, and are oil-immersed with natural cooling. Each transformer is capable of producing the power for one convertor, plus that necessary for the auxiliary services of the sub-station. For this type of installation, the convertors must withstand considerable strain and they are designed to stand an overload of 50 per cent. for two hours, and an overload of 200 per cent. for five minutes.

The inauguration of the electric line has made possible a considerable saving in the time necessary to travel between Bordeaux and Pointe de Grave.

Progress at Sydney, N.S.W.

THE Sydney Electricity Department is owned and controlled by the Municipal Council and supplies direct an area of approximately 150 sq. miles with a population of 866,092, while the aggregate area for which the Department gives a bulk supply is 690 sq. miles with a population of 992,493. Energy is obtained from power stations at Pyrmont and Bunnerong. An increase in the amount of electricity sold from 341,209,822 kWh to 362,787,884 kWh (6.32 per cent.) and in the number of consumers from 204,246 to 209,681 is shown in the annual report for the year ended December 31st, 1933, by the general manager, Mr. H. R. Forbes Mackay.



An aerial view of the Bunnerong power station, Sydney, N.S.W.

Up to the end of the year £18,089,108 had been spent by the Department on capital account.

The total revenue was £2,533,255, an increase of £115,122 over that of the preceding year, and the working expenses decreased from £1,034,062 to £1,020,586. The balance of net profit was £200,909, plus £6,797, bank interest overcharged in 1932, as compared with a net surplus of £43,347 at the end of 1932.

The sales of electricity for different purposes were as follows: Lighting, 3.15 per cent.; power, 38.75 per cent.; kVA factory supply, 9.8 per cent.; street lighting, 3.84 per cent.; bulk supply, 5.25 per cent.; residence rate, 22.79 per cent.; cooking, 0.13 per cent.; commercial rate, 15.96 per cent.; one-meter rate, 38.89 per cent; and for Electricity Department purposes, 0.31 per cent. The average cost per kWh was 1.543d. and the revenue 1.632d. The maximum demand during the year was 114,200 kW, as compared with 125,700 kW in 1932, although the connected load increased from 569,948 to 615,222 kW.

The highest average price paid by any one consumer during the year under review was 5½d. and the lowest 0.53d. per kWh. A number of privately owned steam, oil, and gas engines were superseded by electric motors connected to the Council's mains, and no conversion from electric to any other form of drive came to the notice of the Department. A number of gas and steam heating installations were converted to electricity, and connected load secured under these sections was: 3,796 h.p. of motor drive and 1,140 kW of heating. In the illumination section there was an additional load of 4,094 kW, while heavy duty cooking accounted for an extra 1,144 kW. The number of motors hired out during the year remained about the same as last year, *i.e.*, 2,800.

Uninsulated Neutrals. By B. S. Hornby, M.I.E.E.

The reactive properties of steel armouring in a.c. systems

THE Electricity Supply Regulations, 1934, prescribe (in Section 4) the provision and maintenance of insulated return and neutral conductors on l.v. systems. I submit that there is no need to insulate the return conductor of steel-tape armoured cables on an a.c. system.

If a number of return conductors of equal resistance are connected in parallel that which is nearest the outgoing conductor will carry a greater proportion of the a.c. than the others, and that farthest away the smallest proportion. Thus, if A is an insulated conductor, B is an uninsulated return adjacent to it and C, D and E are paths of low resistance through the earth, B will carry a greater amount on an a.c.

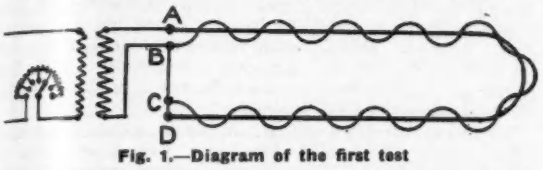


Fig. 1.—Diagram of the first test

system than it would on a d.c. system. Assuming that the conductivity of the earth is uniform between the transmitting and receiving ends, the smaller alternating currents in paths C, D and E would have a tendency to follow the route of A, and would not spread out as would direct currents in similar circumstances.

Now, if A and B were enclosed in double steel-tape armour there would be hardly any appreciable difference between the outgoing current in A and the return current in B, and the currents in paths C, D and E would be negligible, as my tests show. This is the converse of the conditions which prevent the running of two conductors forming an a.c. circuit in different steel tubes.

Results of Tests

A 40-yd. length of 0.022-sq. in. l.v. twin paper-insulated, lead-sheathed, double steel-taped armoured and served cable was run off the drum into a loop and connected to a 50-cycle supply as shown in fig. 1. The resistance of each core was approximately 0.04336 ohm, and the resistance of the short-circuiting connection from B to C and D, 0.001084 ohm. The current in the lead was 40 A and in the return core 29 A with a.c., and 0.97 A with d.c. In the shorting strip it was 11 A with a.c. and 39.03 A with d.c.

When the lead sheath was connected in parallel with the return core their combined resistance was reduced to 0.0317 ohms; the current in the return core was 32 A a.c. and 1.2 A d.c., and in the shorting strip 8 A a.c. and 38.8 A d.c. In this extreme case only 3 per cent. of the d.c. current would return through the cable. Yet the armouring forced 80 per cent. of the a.c. current to follow this path.

The following table gives the results of another test made on the same length of cable to ascertain the impedance when 50-cycle currents of different values were forced through one of the cores and the lead sheath in parallel :—

Current, Amperes.	10	20	30	40	50	60	70	80
Resistance, ohms	0.0319	0.0324	0.0327	0.0330	0.0337	0.0341	0.0347	0.0354
Impedance, ohms	0.150	0.250	0.300	0.295	0.276	0.258	0.239	0.220

The resistance rises slightly due to the excessive heating of the cable, and the impedance increases rapidly up to about 30 A and then gradually falls after 40 A owing to the combined effect of the magnetic saturation of the armour and the capacity of the cable.

The higher figures are, however, only of academic interest, for under the worst fault conditions the leakage current is unlikely to amount to 30 A.

The impedance rises to nearly ten times the value of the resistance, even in a small cable chiefly used for services, so the proportion will be considerably greater in mains with conductors of greater section.

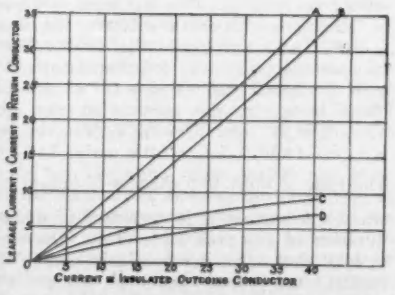


Fig. 2.—Ascertaining the screening effect

The increase of the reactance with the current is also of value, for the greater the difference between the outgoing and return current (i.e., the greater the external leakage current) the greater is the reactive effort of the armour in keeping it in check. Steel conduits used on installation work having greater reactive properties than steel-tape armour, little leakage can occur on uninsulated return conductors drawn into these conduits with their insulated lead.

The Path of Leakage Currents

A test was then made primarily with the object of showing that a considerable proportion of any leakage current that might occur on a h.v. three-phase system would return along the lead sheath and wire armour of the cable. A 78-yd. length of 0.3 sq. in. core three paper-insulated, lead-sheathed and galvanised steel-wire armoured cable was run off and connected as before. Only one core was used as the conducting lead with the sheath and armour in parallel as the return. The resistance of the connecting piece, shorting the return path between B and C and representing an artificial earth, was only 0.0011 ohm; that of the sheath and wire armour combined was 0.027 ohm.

When a single-phase 50-cycle current of 32 A was passed through the circuit 15 A returned through the sheath and armour and 17 A through the artificial earth. If d.c. had been used only 1¼ A would have flowed through the sheath and armour, and 96 per cent. of the total (30¾ A) through the shorting connection. Thus, with an a.c. supply nearly half the leakage current would return by the sheath and armour; with d.c. supply only 4 per cent. would have followed this path.

This test shows that steel-wire armour has considerable reactive properties, but not to the same extent as steel-tape armour owing to the number of slight magnetic gaps between the strands, and to the longer lay of the wire armour.

A further test was made to ascertain the screening effect of steel-tape armour in neutralising the mutual induction when the cable is wound on a drum. A 100-yd. length of 0.022 l.v. twin steel-tape armoured cable was used and four readings at different current densities were taken, first with the cable wound on the drum and then with the cable off the drum. Curves A and B in fig. 2 show the values of the current in the return conductor plotted against the current in the outgoing conductor, with the cable on and off the drum, and curves C and D show the leakage current plotted against the current in the outgoing conductor with the cable off and on the drum. Each pair of curves is sufficiently near the other to show that the screening due to the armour is great.

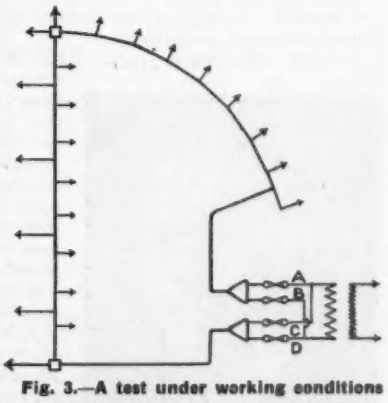


Fig. 3.—A test under working conditions

In Actual Operation

A final test was made under working conditions. The links in two disconnecting boxes on a l.v. twin-distribution system were altered to form a continuous ring main over 800 yd. in length, supplied through double-pole switch fuses, A, B and C, D as shown in fig. 3.

The 150-A switch fuses (together with others) were directly connected to bus-bars of ½-sq. in. section giving an alternative path of even lower resistance than that in the previous tests, a fraction of one per cent. of that of the ring main (which had a resistance of nearly ¼ ohm) and also very much lower than the value of the contact resistance of the sheathing of the cable to earth.

The two sections of the ring main nearest the sub-station (210 and 150 yd.) were 0.15 sq. in. twin-cable and that in the centre of the ring (450 yd.) was 0.06 sq. in. The loads carried by the fuses were: with all fuses in 22A by A and B and 35A by C and D; with A out 60A by C, 56A by D, and approximately 5A by B; with C out 58A by A, 53 by B, and approx-

imately 6 by D. Similar readings at the ends of the ring main were obtained when either A or C was replaced and either D or B was withdrawn.

In addition to the breaks in the armouring at the two disconnecting boxes there were twenty breaks at boxes for branch mains and services. In spite of all these adverse conditions, when any single fuse was drawn on this ring main the retentiveness of the armouring was so great that the remaining fuse on the same end of the ring carried approximately 10 per cent. of the load only, practically the whole of the current being supplied and returned to the other end of the ring.

These tests proved that the reactive effect of the armouring was so great that without an excessive drop in pressure only balanced currents can be carried and that any serious leakage from an uninsulated return is impossible.

I contend that the use of an uninsulated return or neutral should considerably reduce the standing charges of distribution, for not only would the cost of the insulation on this conductor be saved, but in addition there would be a reduction in the cost of the lead sheathing, armouring and serving, due to the smaller diameter to be protected. This saving would, no doubt, be greater on two-wire systems and services, for only one conductor would require insulating and finished cable would be only slightly larger than a single-core cable. It should, however, still be extensive on three-wire and four-wire mains also, for these would be only a little larger than twin and three-core cables, as the neutral conductor would be concentric and in contact with the lead sheath in a similar manner to the B.o.T. earth sheath used in some classes of h.v. cables.

I do not suggest that the sections of return or neutral conductors for uninsulated return systems should be reduced, but the lead sheath—due to its being in contact with the neutral—would materially assist in reducing the drop in pressure and so assist in maintaining better and balanced voltages in the system, particularly where the conductivity of the sheath is maintained by the use of wiped lead or copper shells in cast-iron joint boxes.

Little advantage can be obtained by linking together the neutral conductors only of adjacent four-wire armoured distributors in order to obtain alternative paths for the out-of-balance currents, because, owing to the retentiveness of the armour, each a.c. distributor will retain the greater portion of its own out-of-balance current, and will not permit adjacent mains to assist in equalising, to any extent, the pressure as in d.c. systems. This is another reason why the neutral should be uninsulated, for the additional conductivity of the lead sheath will assist in reducing the difference in pressure between the three-phases and the neutral.

My thanks are due to Mr. H. E. Annett, engineer and manager, Bolton Corporation Electricity Department, and to Messrs. Kilshaw and Yates for their help in making the tests described.

Spare Plant Capacity. By S. A. Swann, B.Sc.(Eng.)

Estimating the chances of breakdown

THE proportion of spare running plant capacity in relation to a given peak load in order to secure reasonable immunity from shut down in the event of failure of any machine is deducible from a simple application of the theory of probability. If a machine is out of service on an average one hour for repairs for every 99 hours' running, we may say that the probability of failure is $p=1/100$, while the probability of immunity is $1-p=99/100$. Assuming that the load is characterised by a series of peaks of duration t and commencing at regular intervals T, when since if a machine fails it is equally likely to fail at any moment during the time T. the chance of any particular machine failing during the period of the peak load is $p\times t/T$. Similarly, the chance that it will not fail is $1-(p\times t/T)$. These chances are taken as p_1 and q_1 for the following example:

A large station contains eight running machines of equal size, of which only six are required to carry the peak load on the basis of 100 per cent. reliability. The probability of a shut down during the peak load is equal to the probability that at least three machines will fail during this period.

Mr. S. A. Swann. A biographical note appears in our personal section

It may easily be demonstrated that if the probabilities of the occurrence of any number of independent events are p_1, p_2, p_3, ... then the chance that they will all occur simultaneously is $p_1\times p_2\times p_3\times$..... An extension of this idea indicates that the chance that three particular machines will fail and the rest be immune is $p_1^3\times q_1^5$, and for the first stage in estimating the required probability we have to multiply this by the total number of ways of choosing three machines out of eight, *i.e.*, ${}^8C_3$, as explained in books on elementary algebra. Thus, the first term of the required probability is ${}^8C_3p_1^3q_1^5$. In a similar manner it may be shown that the chance that four machines will fail during the peak period is ${}^8C_4p_1^4q_1^4$, &c. Therefore, the required probability of partial or total shut down while carrying the peak load is represented by the sum of these terms,

$$i.e.,\ P={}^8C_3p_1^3q_1^5+{}^8C_4p_1^4q_1^4+\ldots\ldots\ldots\ldots+{}^8C_8p_1^8,$$

the last term representing the chance that all eight machines will fail. The equation may be written

$$P=\sum_{s=3}^{s=8}{}^8C_sp_1^sq_1^{8-s}\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

In order to shorten the numerical work involved we may make use of the binomial theorem. We know that

$$(p_1+q_1)^n=\sum_{s=n}^{s=0}{}^nC_sp_1^sq_1^{n-s}\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

This is equal to unity, since $q_1=1-p_1$. Therefore, from (1) and (2) we have

$$P=1-\sum_{s=0}^{s=2}{}^8C_sp_1^sq_1^{8-s}\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

It is seen that the summation in (3) represents the probability of immunity from shut down during the peak period. Thus, equation (3) is merely an expression of the fact that the sum of the probabilities of failure and immunity from failure is equal to unity, which denotes certainty. If the probability p and the periods t, T, are known, the chance of partial or total shut down is found from (3). Conversely, if the probability P is required not to exceed a given amount, the maximum number n of running machines necessary to carry any given peak load is found from the more general relation

$$P=1-\sum_{s=0}^{s=n-r}{}^nC_sp_1^sq_1^{n-s}\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

where r=the number of machines required to carry the load without any spare plant, and n=total number of machines. The proportion of spare machines can be shown to decrease as the total number of machines increases, which is in accord with commonsense, as there is, for instance, more likelihood of shut down with one machine fully loaded and one spare than with, say, five machines fully loaded and two spares.

The assumption of a constant load on the station is unwarranted in the great majority of cases, and calculations confirm the expectation that the chance of shut down is much less than the ratio t/T is taken into account.

In order to give some idea of the order of magnitude of the probabilities involved, the value corresponding to equation (3) is worked out first for a load having regular periodic peaks, and secondly, for a constant load. Assuming $t=1$ and $T=24$, then $p_1=\frac{1}{24}\times.01=.0004$ (very nearly) and $q_1=1-p_1=.9996$ (very nearly). The first term in the required summation is, therefore, ${}^8C_0\times.0004^0\times.9996^8$; the second is ${}^8C_1\times.0004^1\times.9996^7$; and the third ${}^8C_2\times.0004^2\times.9996^6$. The resulting value of the probability P is found to be 3.6×10^{-9}.

In the second case we have $t/T=1$, $P=.01$, and $q=.99$. The three terms in the summation are now ${}^8C_0\times.01^0\times.99^8$, ${}^8C_1\times.01^1\times.99^7$, and ${}^8C_2\times.01^2\times.99^6$. The resulting probability is now 5.4×10^{-5}, *i.e.*, a little under half an hour per annum. The ratio of these two chances of failure is $\frac{5.4/10^5}{3.6/10^9}=15{,}000$, which shows that it is necessary to make allowance for the duration of the peak load. Thus, the expectation of partial or total shut down is exceedingly small. With only one spare machine the probabilities work out at 0.000,004,5 and 0.0027, respectively, the corresponding "expectations" being half a minute per year and one day per year, respectively. Any particular case may be worked out by means of equation (4).

Illumination Values. By K. M. Kharegat, B.A., B.E.

Avoiding tedious calculations

FOR calculating the intensities of illumination obtained on surfaces from lighting fittings, the flux of light method commonly used for interiors gives average results rapidly and easily but is useless if values of illuminations at different points are required. In such cases and in street lighting the usual practice is to calculate the illumination by the point by point method which requires a good deal of time, besides frequent references to tables. The labour can be considerably saved for future work by plotting isolux lines on the plane with the light source at varying distances from the plane, but even then the plotting itself is tedious and figures are not readily available for other distances than those plotted.

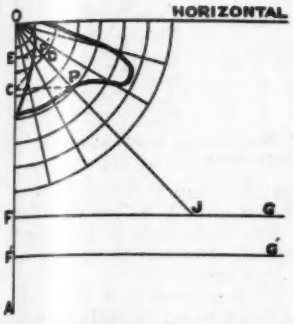


Fig. 1.—Finding the c.p.cos³θ curve for a horizontal surface

A simple graphical method is here given by which the illumination at any point on any plane is rapidly obtained from the polar curve of a given fitting, either without any calculation or by a simple calculation which is easily performed by a slide rule. The method will be found of great use when plotting isolux lines, as such lines can be obtained directly from the construction.

The illumination at any point P on any plane from a light source L is given by the formula: $I = c.p. \times V/LP^2$ where I is the intensity of illumination, V the length of the normal from L to the plane, LP the distance between the point P and light L, and c.p. the candle power given by the light L in the direction LP.

The formula is simple, but the direction of LP and the distance LP cannot be easily computed in every case. The graphical construction aims at evaluating these and at the same time performing the calculation, involving multiplying, dividing and cubing, so as to give the value of I directly.

The construction can be divided into three parts according to whether the illumination is required on a horizontal, vertical or inclined plane. It is essentially the same in each case, but the nature of the first two surfaces enables us to simplify the construction in these instances.

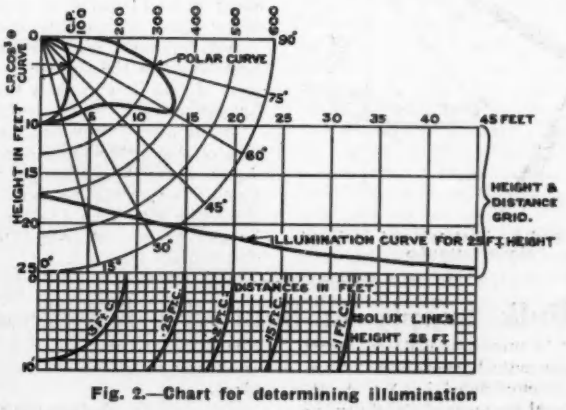


Fig. 2.—Chart for determining illumination

Horizontal Plane Illumination

The illumination on a horizontal plane is given by the formula $I = c.p. \times \cos^3\theta/H^2$. Since H is usually a constant in any given case and is nearly always a small number and an integer, division by H^2 may be performed mentally or by a single setting of the slide rule. Consequently, instead of plotting the c.p. only of the lamp and fitting on a polar curve as is usually done, if the quantity $c.p. \times \cos^3\theta$ be also plotted the calculation is at once performed by taking the appropriate value from the curve and dividing by H^2.

Fig. 1 shows the polar curve of a fitting from which the $c.p. \times \cos^3\theta$ curve is to be constructed. From any point P on the polar curve draw a horizontal cutting the vertical OA in C. From C draw CD perpendicular to OP. From D draw DE horizontally cutting OA in E. Then $OE = OP\cos^3\theta$. Make $OP^1 = OE$. Then the point P^1 corresponds to the point P, and by drawing a curve through all points P^1 the $c.p.\cos^3\theta$ curve is obtained.

The $c.p.\cos^3\theta$ curve has the same value as the c.p. polar curve where it cuts the vertical OA and has the value zero at 90 deg. Then from O set off OF, equal to the height H of the fitting, to any convenient scale and draw FG horizontally. Along FG set off distances from the lamp to the same scale as that used for H. Then the illumination at any point such as J is obtained by joining J to O and noting the value where the line JO cuts the $c.p.\cos^3\theta$ curve. This value divided by H^2 is the illumination at point J. Different lines such as F and F^1 may be drawn on the chart for heights of 9, 10, 13, 15, 20 and 25 ft., and the illumination at any distance and for intermediate heights can be easily obtained by interpolation. Such a chart is shown in fig. 2.

As an alternative method let RS in fig. 3 be a portion of the polar curve of a fitting and OF the height of the fitting H to any convenient scale. Draw FG horizontal to the same scale; plot distances from the fitting along the horizontal plane on FG. To find the illumination at any distance J, join JO and from the point P where it cuts RS draw CP horizontally; join CJ. From J set off a distance JK or JK^1 equal to 1 in. or 10 in. From K (or K^1) draw a vertical KN (or K^1N^1).

From F lay off FE along OF equal to the intercept KL (between OJ and CJ in KN); join EJ. The intercept MN is then equal to the illumination at J. From M draw a horizontal line till it meets the vertical ordinate at J, and JD is then also the illumination at J. Similarly, other points J_1, J_2, J_3 . . . will give D_1, D_2, D_3, &c. . . . and by joining the points D_1, D_2, D_3 . . . the curve of variation of illumination with distance is readily obtained. From this curve isolux lines (for a symmetrical fitting) can at once be drawn as shown in fig. 2.

If c candle-power be represented on the chart by 1 in. and h feet by the same dimension, then if JK be taken equal to 1 in., the length JD in inches multipled by c/h^2 will give the illumination in foot-candles. If the length JK be 10 in., JD multiplied by c/h^2 and divided by 100 will give the illumination in foot-candles. For interiors JK is taken at one inch, but for street lighting at 10 inches. Since the illumination $= C/h^2 \times 1/JK^2$, the scales must be chosen so that this quantity is either equal to 1, 10 or some multiple or submultiple of 10; then the length JD in inches will give the illumination without calculation.

The figures show the constructions for fittings, giving a symmetrical light distribution. For asymmetric fittings polar curves can be drawn at different horizontal angles, and illumination curves corresponding to these angles and isolux lines can be constructed as before.

Vertical Surfaces

The illumination on a vertical plane at any point P in fig. 4 is given by the formula $I = cp. \times /(X^2+Y^2+H^2)3/2$, where X is the perpendicular distance between the light source L and the plane H the height of the light source above the point P, Y the distance in the horizontal plane between the foot of distance X to the point P, and c.p. is to be taken at the angle (θ) of incidence on the vertical surface.

Draw the $c.p.\cos^3\theta$ curve as shown. From O in fig. 6 set off OF = H to any convenient scale. Make OX along OF = X to the same scale and draw a perpendicular XG to OX at X, and equal to Y also to the same scale. Join JO and let it cut the $c.p.\cos^3\theta$ curve in P. Join FP. From X draw XP″ parallel to FP. Then OP″ divided by H^2 is the illumination at J.

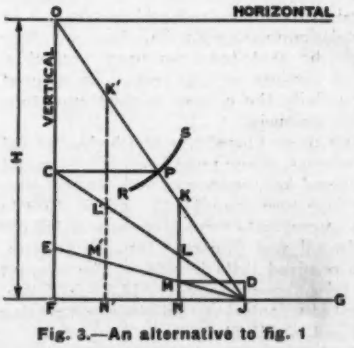


Fig. 3.—An alternative to fig. 1

For a given plane and light source X is a constant and a curve CP″O can be drawn for every point on the $c.p.\cos^3\theta$ curve. The c.p. corresponding to P″ can then be read off at sight and this value divided by H^2 (which will vary with the point P) will at once give the illumination. Isolux lines for a given value of X can be drawn by giving to H successive integral values.

Another method is as follows: Let RS in fig. 7 be a portion of a polar curve and OF = H to any convenient scale. To the same scale make OX = X and draw XG perpendicular to OX and equal to Y; join GO. Through F draw a horizontal and make FJ = GO. Join OJ and let it cut the curve RS at P; join FP. From X draw XP′ parallel to FP, and let it cut OP

in P'. From P' draw a line horizontally and let it cut OF in C; join CJ. Make JK along JO equal to 1 in. or 10 in. and KN vertically. Set off FE equal to the intercept KL on KN. Join EJ, then the intercept MN is equal to illumination at J. From M draw a horizontal to cut the vertical through J in D. Then the ordinate JD is also the illumination at J.

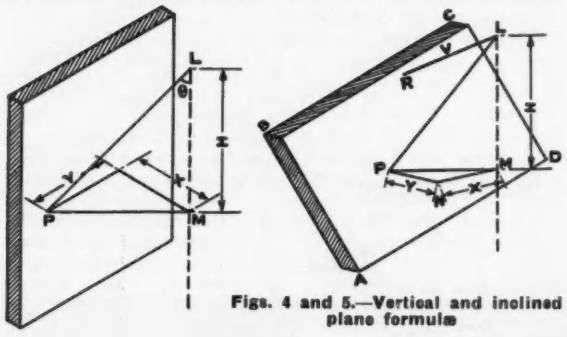
Similarly, for other points J_1, J_2, J_3 . . . , D_1, D_2, D_3, &c., may be obtained and a smooth curve drawn through them will give the illumination at any point along a horizontal line on the vertical plane. By taking different values of OF isolux lines can be easily and rapidly plotted. If a large amount of this type of calculation is to be performed it will be found simpler to plot permanently curves forming the loci of points P' for different values of X, somewhat similar to the curve CP"O in fig. 6. The value of P' can then be obtained by interpolation for any intermediate value or X and the amount of construction lines reduced.

If c candle-power be represented on the chart by 1 in., and h feet a similar dimension, and if JK b n inches, then each inch on $JD = C/H^2 \times 1/n^2$. JK may be taken 1 in. for interior work or where the intensity of illumination is large, and 10 in. if it is small. C/h^2 must be taken so that its value is equal to 1 or 10 or multiples or sub-multiples of 10.

Inclined Planes

In fig. 5 let ABCD be the inclined plane, L the light, and P the point at which the illumination is required. Let LM be drawn vertically from L and let the horizontal plane from P cut it at M. From M draw MN, and from L draw LR perpendicular to the plane ABCD, cutting it in N and R respectively. Join PN. Then the illumination at $P = c.p. \times V/(H^2+X^2+Y^2)3/2$ where V=LR and c.p. is at angle θ.

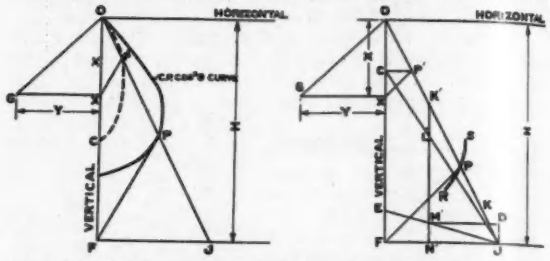
As this formula is similar to that given for illumination on vertical surfaces, the two methods given for vertical planes will apply, with a slight change. The change consists in taking



Figs. 4 and 5.—Vertical and inclined plane formulæ

a further distance OV along OF and equal to V and drawing lines parallel to FP from V and not from X as shown in figs. 6 and 7.

Appropriate values should be substituted for H, X, and Y, and instead of the inclined co-ordinates X and Y shown on



Figs. 6 and 7.—Two ways of determining illumination on the vertical plane

fig. 5, rectangular co-ordinates X^1, Y^1 can be substituted without any alteration. Thus, if the point P be given as 10 ft. below, 5 ft. to the left and 8 ft. to the front of the light L, H=10, X^1=5, and Y^1=8, and these measurements need not be converted to express them in X and Y; and OX=5, OF=10, and XG=8 in figs. 6 and 7. V is constant for a given plane and lines similar to CP"O can be drawn permanently for values of V and then, by taking different integral values of H, isolux lines can be plotted. As both V and H vary independently, the case of obtaining illumination on different planes by a single simple construction is lost, but results can be obtained more quickly than by direct calculation.

Of the two methods given, the first will generally be found to be adequate, especially if horizontal illuminations only are required. By plotting both the $c.p.\cos^3\theta$ curve and the height and distance grid on the polar curves permanently as shown in fig. 2, the illumination can be read off almost at sight or by a simple calculation. The second method is useful if illumination along different portions of roads, average illuminations, or isolux lines, &c., are required.

Both methods are in reality the same in all three cases, because when the surface is horizontal X and V=H, and in view of this simplification the construction of the two parallel lines is omitted.

In the figures only one quadrant is shown, but the extension of the method to other quadrants presents no difficulty. Again, in all the figures the point P is shown below the light source L or O; if it be above the light source the distance OF should be set off on FO produced and, similarly, OX should be on FO produced, beyond that no further change in the constructions is required.

Bulk Supply in Southern Rhodesia

THE supply of electric power to mines, industries, farms and private householders from central generating stations in Southern Rhodesia has been recommended by Mr. A. R. Metelerkamp, the municipal electrical engineer at Salisbury, in a report to the Minister of Mines. This development would mean a new lease of life for the large number of small mines now opening in the territory, most of which operate either on gas (using timber for fuel) or oil, which is expensive, because of the distance of transport. A number of small towns would also find bulk supply more attractive than running their own plants.

The matter arose out of a proposal by Mr. T. G. Golding, of Gatooma, that a central power station should be erected in that town, and Mr. Metelerkamp suggests that there are other areas in which it might be exploited even more profitably, such as the Selukwe and Bindura mining areas. On account of the existing mining activity the present is most opportune to consider this proposal seriously.

Any scheme promoting more liberal use of Rhodesian coal would also benefit the railways, create more employment, assist the coal-mining industry and keep money in the country. Imports of fuel oil (duty free) rose from 448,073 gal. in 1932 to 1,039,854 gal. in 1933 at approximate respective costs of £20,000 and £45,000, and as the oil was imported through Durban, the Rhodesia Railways received little benefit. The amount imported in 1933 would be sufficient to produce 13,000,000 kWh, which could be generated at a central station at Gatooma using 13,000 tons of coal at a cost of £15,700.

Southern Rhodesia has extensive coal fields, and the only producing colliery recently issued a statement that if its present output were doubled the resources would suffice for 2,000 years. Mr. Metelerkamp points out that in Rhodesia seventy-four square miles of country were being denuded of timber for fuel each year. Cheap electrical power for dewatering would probably enable some abandoned mines to be reopened at a small capital cost. At 1d. per kWh it would pay a small worker to install an electric motor in preference to any other plant.

A Question of Economics

Supply to the mines could be given by a system of radiating transmission lines, and a hire-purchase system for motors would enable the greatest possible number of consumers to be obtained in the shortest period.

The Gatooma Municipality would probably become a bulk consumer of the undertaking and could reduce its tariffs. A 2,000-kW station would be sufficient to supply the estimated present requirements. The estimate of revenue is based on the sale of 5,500,000 kWh a year, but the proposed station would probably be capable of generating 11,000,000 kWh annually. If the sales were doubled energy could be sold at an average price of 1.75d. per kWh, and the net surplus of the undertaking would be over £10,000 per annum. The capital cost of the lines is estimated at £56,000, assuming the use of second-hand steel rails of 60 lb. per ft. section for supports. The capital cost of the power station, with two 2,000-kW turbo-alternators, would be £58,000, giving a total of £114,000.

The annual capital charges are estimated on a repayment period of fifteen years. The total annual expenses are estimated at £23,883, based on the following assumptions: 5,500,000 kWh sold, 6,250,000 kWh generated, 12 per cent. distribution losses, coal at 25s. per ton and 2.1 lb. per unit generated. The gross revenue, based on fifty average small-workers with an average consumption of 100,000 kWh per annum plus consumption in Gatooma and Hartley, was estimated at £25,000, showing an annual profit of £1,000. The estimate of revenue assumed an average price of 1.09d. per kWh sold. Three transmission lines were included in the estimate, covering an area extending to Chakari, Gadzema, Hartley and the Owl Mine districts. With 136 miles of line it would be possible to supply the fifty-seven mines now in production.

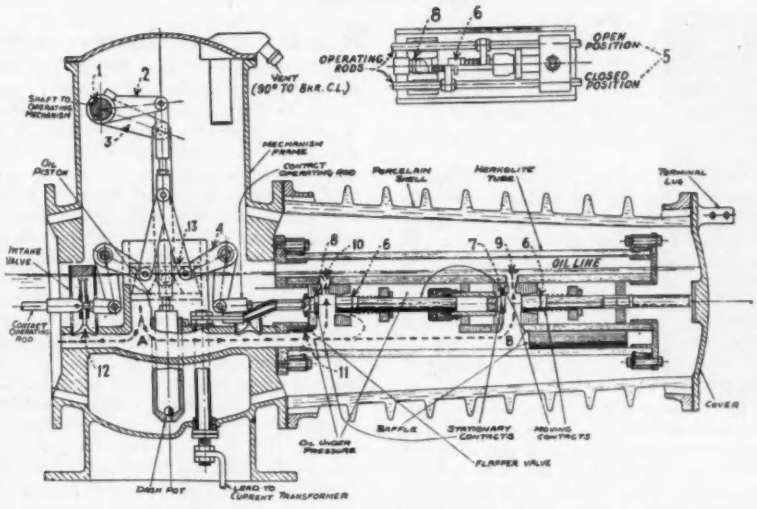
A New Impulse H.V. Circuit Breaker

IMPULSE circuit-breakers in which a piston drives streams of oil into the arc path when the contacts separate are to be used to control the two 287-kV transmission lines from Boulder Dam (Los Angeles). The eight breakers to be installed are of a new design by the American General Electric Co. Their short-circuit rating will be 2,500,000 kVA and their opening time three cycles (0.05 sec.) compared with eight cycles, the fastest hitherto available for high voltages.

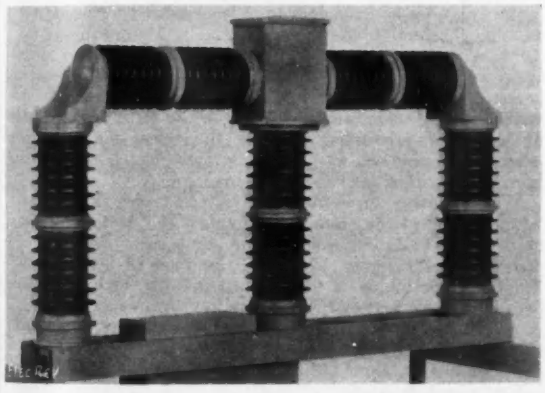
Each unit will have eight breaks in series, the two associated pistons being driven by a common mechanism. The current transformers for the relays on each side of the breaker support the ends of the interruption units; the central column supports only the operating mechanism.

To deal with differential expansion between the supports and interruption units, the supporting structure is built like a two-span bridge with an articulated joint in the centre and rollers at the end. The diameter of the porcelain bushings is somewhat larger than with the ordinary tank type of breaker, but the external length is about the same.

The main operating rod is connected by a clevis to a crank on the main operating shaft 1, shown in the part section.



Part section of a 138-kV impulse breaker



A 287-kV impulse oil-immersed circuit-breaker

The breaker is closed by the counter-clockwise rotation of the shaft, which is operated by a spring wound by a motor and gear train. This shaft carries two other cranks, 2 and 3. Crank 3 is linked to the piston 13, and lifts it up during the closing stroke, drawing up oil through valve 12 into a pressure chamber A. During the closing operation, the drawing of oil from the contact regions is prevented by a flapper valve 11. The oil returns to the centre casing, where any carbon or contact particles settle.

Crank 2 is linked, via crank 4, to two horizontal parallel operating rods 5 (shown in the smaller illustration), which, sliding on rollers, extend along the other units, and carry the moving contact 6. As the breaker is closed, these rods move inward (to the left) and engage the stationary contacts 7 and 8. Current passes from the connection end cap to the first movable contact 6 by a flexible lead; then going from the stationary contact 7 to the second moving contact 6 through a silver coated joint; and finally, from the stationary contact 8 through an insulated lead to a current transformer in the supporting column.

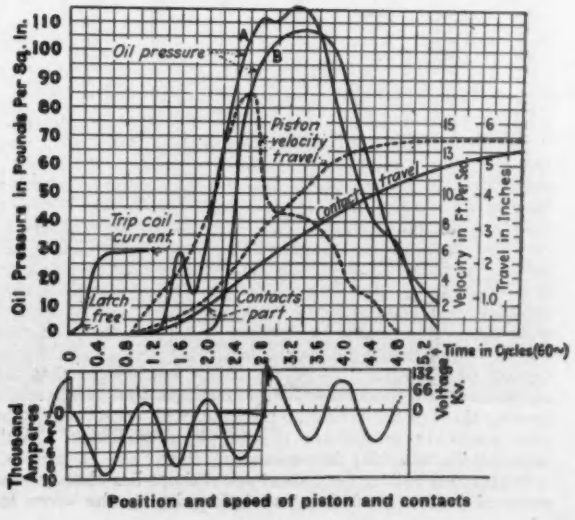
The spring that causes shaft 1 to rotate clockwise is designed to give a high mechanical speed in tripping. The contacts move outward and the piston 13 moves down; the oil closes valve 12, lifts valve 11, and passes up through ports 9 and 10. The oil traverses the path shown by a dotted line, washing the arc into these passages, and at current zero a wall of solid oil separates the ionised gases from the contact surfaces of each pair of contacts. The circuit-breaker has four pairs of contacts, so that a total of eight oil walls oppose restriking of the arc.

The assembly of contacts, operating rods, etc., is mounted in a herkolite tube that supports all working parts and sustains all pressures and mechanical stresses. These herkolite tubes are protected by porcelain shells which merely carry their own weight and hold part of the 96 gal. of oil contained in the unit. The inside of the tube is divided by a horizontal diaphragm slightly below the oil level. This diaphragm separates the oil distributing manifold from the air space into which oil and gases discharge during interruption.

The pressure to produce an oil jet of a given velocity for a given time is proportional to the square of velocity, the energy to maintain this velocity for a given time to the third power and the dielectric strength to the first power. In a tank type of breaker the contacts are surrounded by an earthed metal cylinder of high electrostatic capacity; this concentrates most of the voltage on the breaks nearest to the bushings and very little dielectric strength is added by additional breaks. But with the contacts arranged in line, the end shields and central housing provide a fairly uniform distribution of potential between the two breaks in each arm of one unit.

The capacity of the central housing to earth produces some unbalance between the two arms of one unit. Under a fault that imposes the severest voltage (three-phase unearthed) the clearing phase receives 0.866 of the line voltage, one-sixth of which is available to charge the central housing. With the potentials encountered by the first phase to clear the potentials across the four contacts measured from the line are 36, 24, 16, and 24 per cent. No earthed parts are near the live conductors as with the ordinary oil circuit-breaker. When the contacts are closed the entire rupturing unit is at line potential insulated from earth by the insulating current transformer column. When the contacts are open, potentials are distributed over the entire structure according to the electrostatic capacities.

Laboratory tests have established the required oil velocity for maximum voltage at maximum recovery rate (2,000 V per microsec.) with most unsuitable location of ground and showed that the extinction of the arc is a function of oil



Position and speed of piston and contacts

velocity, not current, which does not change the oil velocity.

Measurements from oscillograms taken together on a 138-kV breaker are embodied in the composite chart reproduced. Most of the time in operation is consumed in accelerating the mechanical parts; the actual arcing time was 0.9 cycle.

From the oil jet equation the oil velocity should clear with a recovery rate of 3,430 V per microsec. with the two breaks; whereas, the actual recovery rate was 2,100. Successful interruption was, therefore, to be expected, even though the contact separation was only 3.8 in. for the two breaks in series. There is some difference between the values of pressure at the piston and at the end of the pressure manifold, owing to the momentum of the oil column and deflection of parts. Due to the same causes, there are also discrepancies between observed piston velocity and oil velocities which are calculated from pressure. Tests of ultimate capacity were successfully made with the test transformers connected in series to give 264 kV at 4,800 V per microsec.

"Lay" in Cables. By W. E. Bradshaw, A.M.I.E.E.

THE term "lay" denotes the rate of spiralling of conductors in a cored cable. The official definition is "the pitch of the helix formed by any individual wire in a stranded conductor, or by any individual core in a multi-core cable."

The lay is usually measured in inches, and is the distance measured along the cable between the point where a certain conductor is, say, at the top to the next point when it arrives at the top, having made one complete revolution. As each conductor has its colour significance, it is necessary to know its location at the terminal ends of the run and sometimes its behaviour *en route*. Looking at the end of a cored cable, the rotation is usually clockwise; that is to say, if the cable were cut a few inches away from the end, the top conductor would have moved clockwise, and at a quarter of the lay would be at the "12.15" position.

Let it be said, although it is really obvious, that it does not matter which end one looks at, there is no difference in the direction of rotation. In stating this, however, it should be noted that the direction of spiralling of the cores only is referred to. It is different with the colours, which will not be in the same position relatively to each other when looking at opposite ends of a length of cable. In a three-core cable, while the colours will appear red, white, blue, in a clockwise direction at one end, counting in the same direction at the other end they will appear red, blue, white. This is, of course, important when jointing.

A Lack of Standardisation

There is no standardisation with regard to lay in cables. The only recognition made by the British Standards Institution is the above definition and a permissible increase of resistance of 2 per cent., due to the laying up of the cores. In 100 yards of cable a permissible increase of length of two yards is thus allowed for. Cable manufacturers have their own methods of calculating what the lay shall be. Moreover, in a given works, no two cables will necessarily have the same lay, except where they are of the same size and type for the same pressure. Even in this case some variation may be experienced, as they may be laid up on two different machines that may have slightly different ratios of travel and revolution. Thus, there can be variations in different drums of cable from the same source. The cable makers can state, however, the lay on any particular length of cable if it is asked for. The accompanying table shows the lay for different types of cable and the variation which may be experienced from different manufacturers.

TABLE SHOWING LAY OF REPRESENTATIVE SIZES OF CABLES.

Cable.			Manufacturer.				
					C.		
Section. sq. in.	Voltage.	Type.	A.	B.	C.1. Straight Cores.	C.2. Pre-spiralled.	D.
			in.	in.	in.	in.	in.
0.2	22,000	3-core	39	72	60	70	—
0.2	11,000	3-core	66	72	42	70	55
0.2	6,600	3-core	64	72	36	70	48
0.3	660	4-core	77	72	48	84	55
0.3	660	3-core	77	72	40	84	48
0.2	660	4-core	66	72	36	70	48
0.2	660	3-core	66	72	30	70	48
0.1	660	4-core	45	60	30	60	48
0.1	660	3-core	45	60	24	60	36

The diameter of the laid-up cable does not necessarily control the lay. The table shows that a 0.2 sq. in., 11,000-V cable and 0.2 sq. in., 6,600-V cable with different laid up diameters have the same lay. In this case the lay has been controlled by the machine. While on the question of manufacturers it should be mentioned that cores, before being laid up into a complete cable, may be subjected to pre-spiralling. If the lead is stripped off a length of cored cable with shaped conductors, about 10-15 ft. long, and the conductors are separated without any attempt to straighten them, it will be found that each conductor is in the form of a spiral. Unless pre-spiralling is adopted, it will be appreciated that the insulation cores have been forced into the spiral shape while passing through the laying-up machine, with consequent twist and possibility of damage to the paper insulation. With large cables, this may be serious.

With pre-spiralling the correct spiral shape has already been assumed before insulating and before laying the cores together. They will then fit into position with less danger of damage to the insulation. Special "sun and planet" motion machines are necessary for this refinement, which, however, is becoming general practice, although it is not so at present. Pre-spiralling makes the handling of the cores by a jointer somewhat more difficult, as they do not tend to spring apart as in other cables. The effect of pre-spiralling, seen under C.1 and C.2 in the table, is to lengthen the lay which is, perhaps, contrary to first impressions; C.1 is cable laid up without, and C.2 with, pre-spiralling in the same factory.

What does the mains engineer want? The practical limits are set by the purpose for which the cable is destined to be used. High-voltage cable cores are only handled at straight-through joints and at the terminal ends. A reasonably long spiral helps the jointer to "marry" the cores, with as little movement of the latter as possible. The less the cores are moved the less danger is there of damaging the paper at the "crutch," where the cores are fixed by the belt and lead sheath. On the other hand, a short lay makes a more compact cable, with less possibility of air spaces forming between cores when bending the cable during laying.

A somewhat different point of view obtains when dealing with l.v. distributing cables. The commonest distributors have four cores which have to be separated when the cable is lying in the ground and practically taut. Moreover, they must be handled "alive," being sprung apart by wedges sufficiently to enable services to be tapped off. A long lay is needed as a short lay locks the cores together more tightly. In such cases engineers frequently specify the lay they require. It is of little consequence to the manufacturer, as, theoretically, the longer the lay the less copper is used in a given length of finished cable. The only reason the manufacturer has for shortening the lay is to make a more compact cable at the cost of employing slightly more copper. The importance of this matter is shown by the table. Whereas one manufacturer is making l.v. cable with a lay of 72 in., another maker is only using a lay of 36 in. in the same type of cable. It would be interesting to hear the remarks of a jointer who has to connect up "live" services to 0.2 sq. in. four-core cable with a lay of only 36 in.

When jointing three-core high-voltage cables the minimum of movement of the cores is to be aimed at. As a consequence it is usual to ignore colours and joint them as they come together at the joint. The cores can then be tested through from the open ends of the completed cable, and any change which may be necessary made at the trifurcating boxes. It is advisable, however, to note how the colours are actually arranged at each joint, as this may come in very useful at a later date, should the cable have to be opened up anywhere along its route.

Maintaining the Correct Order

It is advisable not to change the clockwise arrangement of the colours along the whole route of the cable. That is to say, looking away from the power station towards the sub-station, the colours should always read red, white, and blue. Should it be impossible to change the conductors over at the terminals in order to secure correct polarity, it may be necessary to put the colours right in one of the straight-through joints. By using a long sleeve it may be possible to change colours round a third of a revolution in the same direction as the spiral. It is unpleasant, however, to be faced with the necessity of crossing two conductors completely over in a straight joint.

The direction or rotation of the colours depends on how the foreman draws in or lays the cable. It also depends upon how the manufacturer has left the cable on the drum. This, in turn, depends on the operations performed on the cable after the laying up of the cores. If it is necessary to pass the cable through a machine again after the laying up, the end coming uppermost on the drum will obviously be reversed.

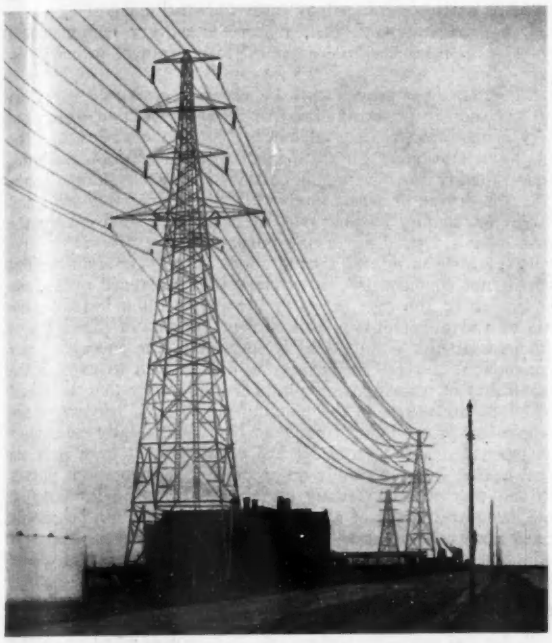
Usually the manufacturer endeavours to leave the loose end with the colours clockwise, *i.e.*, red, white, blue. If the machine alters this, however, he will not again rewind the cable unless there is some special reason. Again, it is not always convenient when installing the cable for the foreman to draw in or lay the cable lengths all in the same direction.

Electricity Supply in Northern Ireland

The first full year's activities

THE second annual report issued by the Electricity Board for Northern Ireland (27, Great Victoria Street, Belfast, 1s.) relating to 1933 records the activities of the first full year in which it has been possible to pursue an active sales policy. The Board purchases electricity at cost from the selected station of Belfast Corporation and is continuing local generation in places not served by transmission lines. The small generating sets are transferred from point to point as the h.v. system is extended. The kWh purchased was 7,810,000 and the amount generated locally 932,000. The total of 8,742,000 was 160 per cent. in excess of the figure for 1932, the load factor increasing from 21.8 to 24.9 per cent.

During the year the Board constructed twenty-four new l.v. distribution systems, bringing the total number served to forty-five, with twenty-two more in course of completion. For the projected supply to the Western area, a 33-kV line is to be erected on concrete supports.



Belfast Harbour power station and outgoing transmission lines

The kWh sold amounted to 7,195,000 at an average overall price of 2.04d. per kWh (domestic 2.33d., power 1.24d., and public lighting 3.26d.). The average amount of energy sold per domestic consumer was 723 kWh. There were 8,186 consumers in this class—over one-third of the possible maximum—(an increase of 123 per cent. over the previous year) but the number at the end of last month had risen to 15,200.

During the year the number of cookers installed increased from 269 to 1,236, but this year so far the progress has been even more remarkable — over 2,400 cookers now being in use. Cottage equipment and breakfast cookers, which numbered 2,500 at December 30th, are now over 4,100. New power connections last year included 1,200 h.p. for the linen industry (for which other negotiations are in progress). Greenhouse heating called for 100 kW and one of the many poultry farms supplied requires 50 kW. Another popular demand is for small automatic pumps. Five hospitals were equipped for cooking as well as for electro-therapy, and others are shortly to be supplied.

The principal tariffs are: domestic, a fixed annual charge of £1 11s. 3d. for 500 sq. ft. to £10 for 6,000 sq. ft. and 0.4d. per sq. ft. over 6,000 (for farm out-buildings all over 500 sq. ft. is charged at 0.2d. per sq. ft.) plus 0.75d. for first 400 kWh per summer quarter and 600 kWh in winter quarter, and 0.5d. for the rest; industrial power (2 h.p. and over), first 50 kVA of maximum demand per month 9s., above 50 kVA 6s., and 0.5d. per kWh; power (block tariff) 2d. per kWh for the first 4,800 kWh per annum, decreasing to 0.65d. per kWh for more than 1,920,000 kWh per annum, subject to a coal clause; water heating (night with time switch) 0.33d.; long-hour space heating, 0.75d.; large heating installations, electric boilers and furnaces, 0.3d. Apparatus let on hire and hire-purchase terms, including house wiring, cookers, wash-boilers, hot-water tanks, immersion heaters, and cottage equipment. The cooker hire covers a four-pint electric kettle and a five-pint flat-bottomed aluminium stew pan.

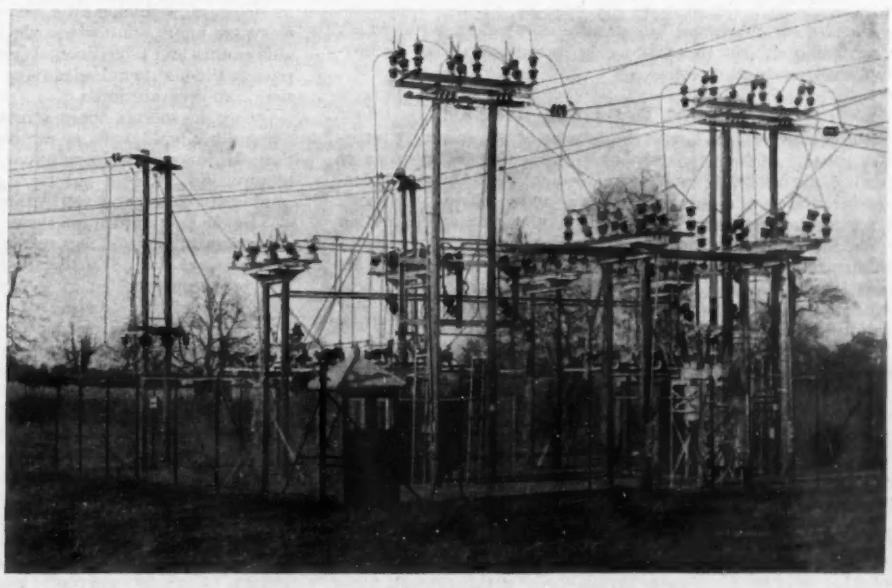
Mr. C. R. Westlake, engineer and manager of the Northern Ireland Electricity Board

Six main and five subsidiary showrooms have been equipped. Apart from the cooking demonstrations given there, upwards of 200 demonstrations were given in the year in twenty-three towns and villages to over 7,000 people. Fifteen districts used the Board's supplies for public lighting. The Board acquired four existing undertakings in its south-eastern area (comprising the counties of Down and Armagh as well as part of Tyrone) and the Enniskillen undertaking in its western area (comprising the county of Fermanagh and the major portions of the counties of Tyrone and Londonderry). Three more undertakings were acquired last January and eleven in April, and these are now being reconstructed.

Under its Act of 1931 the Board may borrow £1,500,000, the Ministry of Finance guaranteeing the principal and interest for five years from the establishment of the Board. Sinking fund payments may be suspended for up to five years.

In 1933 the gross revenue was £64,242 and working expenditure (excluding interest and sinking fund charges) £40,292.

In the interim report of Mr. J. M. Kennedy, then consultant to the Board, it was estimated that by 1933-34 the capital expenditure on high-voltage transmission would be £245,000 and that 5.03 million kWh (20.9 kWh per £ of capital) would be delivered to the low-voltage networks. The actual expenditure at the end of 1933 was £268,000 for 6.72 million kWh (25.1 kWh per £ of capital).



A view of the Armagh main sub-station

The Improvement of Domestic Appliances. By F. D. Parker

Some desirable constructional features

THE last few years has witnessed much progress in the general design and efficiency of domestic electrical apparatus. The present wide diversity of applications and designs are indicative of the ingenuity displayed, and show that manufacturers realise the potentialities of domestic development.

Both from the constructional and æsthetic points of view radical departures have recently been made from traditional design and layout. Streamline construction, rounded and bevelled edges to eliminate the accumulation of grease and facilitate cleaning, plug-in elements and interchangeable parts, feather-weight action handles on doors and even foot controls are now becoming a commonplace.

Such arrangements greatly enhance the appeal and sales value of appliances. For instance, in the case of a domestic refrigerator, a foot controlled automatic door release is an invaluable adjunct; the hands of the operator are often full and such a device obviates the necessity of putting things down in order to open the cabinet door. The elevation of cookers and refrigerators to a convenient height to avoid unnecessary bending and permit a broom to sweep beneath such normally unmovable appliances is another valuable feature attractive to the efficient housewife.

Mr. F. D. Parker is an assistant engineer in the Lighting and Heating Department of the North-Eastern Electric Supply Co., Ltd.

Unfortunately the same amount of forethought is not evident in the design of all classes of apparatus, especially with regard to the thermal insulation of connecting flexes, terminals, location and fixing screws. More stress has yet to be placed upon the factor that a layout designed to facilitate quick and easy renewals materially contributes to low repair charges. Neglect of one or two small essential features often results in an otherwise well designed and constructed appliance being condemned as unsatisfactory.

A typical instance is the placing of cooker sub-circuit fuses. These may often be found under the hob plate necessitating the removal of cooking utensils, numerous screws or nuts and the lifting of the hob—sometimes when the cooker is hot. Another favoured position is behind the grill chamber, an utterly impossible situation from the point of view of quick renewal, especially by the consumer. A method of clamping mica embedded elements to the base of heating appliances without the employment of excessive numbers of nuts (which after being subject to continual heat become almost unmovable) has yet to be evolved.

Better Heat Regulation Required

Electric irons and kettles have now attained a very satisfactory stage of development, but in instances other than water heating when a kettle can be employed, electric boiling apparatus is still at a disadvantage from many points of view. Ignoring the questions of efficiency of utilisation and operation costs, the chief drawbacks to the ordinary cooker hot-plate or boiling ring as revealed by experience are :—(1) Considerable time lag in reaching maximum heat; (2) Unsatisfactory heat regulation, and, especially in the case of medium heat, poor uniformity of heating.

In some hot-plate designs there is really no intermediate stage of heating between high and low heat. The medium heat merely gives a located high heat from one section of the plate. As the latter is often of very limited area, the utilisation of more than one utensil is sometimes prohibited. A more efficacious arrangement would be to always utilise alternative elements in the medium heat position. This layout heats the plate more uniformly throughout its entire surface.

One is prompted to conjecture, however, whether the heat regulation obtainable by ordinary three-heat switching is comparable to that offered by gas for cooking purposes, and whether in order to compete satisfactorily in this respect, more than three heat switching ought not to be employed. In overcoming this difficulty, although introducing others in regard to excessive weight, etc., the transformer coupled hot-plate possesses a material advantage as any desired amount of heat regulation can be easily and cheaply obtained by the employment of multiple tappings on the primary side of the supply transformer.

Water Heating

The trend of water-heating development in some measure appears to be governed by the nature of the tariff available. Very efficient local heaters are now to be secured, but the methods of conversion of ordinary hot water systems still leave much to be desired. Converted electric hot water systems with their efficiently lagged storage tanks and pipework do not so readily lend themselves for the purposes of towel drying and even space heating as do their coal-fired contemporaries. Additional provision must therefore be made. Low temperature tubular heating arranged to fulfil the dual purpose of space heating, towel drying, etc., represents a very commendable solution in instances where capital cost is not of primary importance.

Experience has proved that the situation of storage cylinders and subsidiary pipework, relative to the walls and corners of rooms possesses a material bearing on the heat losses. The fact that stationary air is in itself a good thermal insulator, might justify the placing of partially unlagged storage tanks in small drying or airing cupboards, or alternatively sectionalising the lagging so that part of it may be removed by the consumer if desired for drying purposes.

It is a little surprising that although many supply authorities would not consider issuing cookers with unlagged ovens, the consumer in the case of water heating is often left to make his own arrangements in this respect, in spite of the fact that efficient lagging is an essential element in the success of any conversion. Supply authorities would do well to explore the possibility of utilising their plumber-jointers for this work and to effect alterations to the existing pipework if necessary, the whole conversion being completed by them. Many consumers at present refuse to consider the conversion of their existing fuel heated systems simply on account of the trouble it entails in the way of interviewing plumbers, arranging for lagging, etc. The utilisation of a type of lagging which can be readily fixed and removed such as strip type wool and asbestos sacks which could be hired in the normal way with the water heater is a feasible arrangement.

Concerning the loss by conduction, the employment of heat insulating and resisting collars or joints between the storage cylinder and connecting pipework, in instances where the latter is unduly long has yet to be explored. The tendency to carry fixing and element clamping screws through into the inside of water-heating apparatus is still very prevalent, in spite of the fact that each screw represents a potential source of leakage if the appliance is permitted to become overheated.

Dual-purpose Appliances

There is room for the production of a small combined washing machine and wash-boiler. Although the tendency may be to dispense with domestic servants and patronise laundries, there are many housewives who prefer to wash the more valuable clothes and table linen at home. Such an appliance would possess the additional advantage of occupying much less space than two separate units.

Owing to serious space limitations in modern houses and flats, either building in or combination of appliances into compact single units is becoming a very necessary and essential requirement. A lead has been given by the production of a combined cooker and refrigerator. More subsidiary use could also be made of appliances themselves—the provision of a small ice cream conservator in a refrigerator is an amenity attractive to the housewife and small café proprietor. Electric clocks have also been incorporated in the construction of refrigerators to serve as part of defrosting devices, also in wireless sets. In the former case the electric clock is invaluable in a kitchen where the success of cooking operations is largely dependent on accurate timing.

Electric clocks incorporated in the bases of table lamps have yet to be extensively produced. Such arrangements, besides being of considerable artistic attraction, would permit manufacturers unlimited licence in the development of new designs, especially for bedside purposes where the presence of a clock is often very desirable.

Vacuum cleaners present an enigma. That the retail price of such apparatus, should, in the average case, be in excess of that of a medium-sized cooker is incomprehensible. For general cleaning purposes such apparatus is admittedly supreme, but its high cost compared with other household appliances is a severe hindrance to increased sales.

No development has rivalled domestic artistic illumination. People of moderate means can, by the introduction of inexpen-

Correspondence

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Electrification and Air Attacks

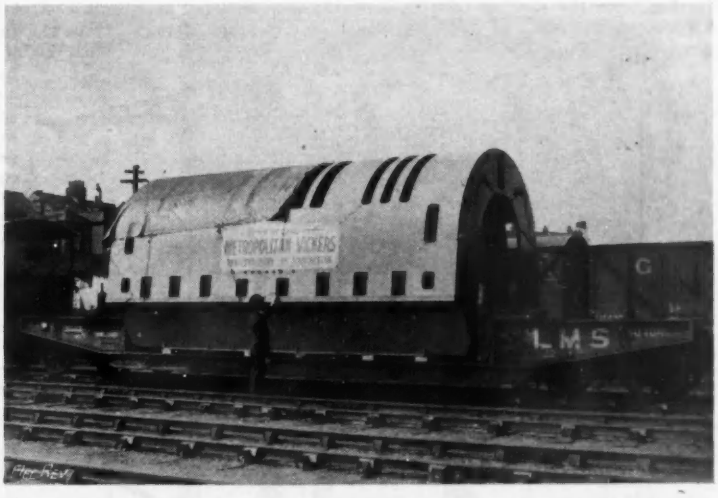
We have heard a good deal lately in this country regarding the alleged vulnerability of electrified railways under attack from hostile aircraft. A bomb dropped from an aeroplane on a power station or on a "pylon" might, it has been suggested, put a considerable mileage of track out of commission. But surely a more likely target would be the permanent way, which is liable to damage whether steam or electricity be used for propulsion.

Moreover, an extensive system of overhead electrical equipment lends itself well to taking supplies from alternative sources, such as would be available from an interconnected grid system. With regard to short delays, during the last war the steam trains were held up for appreciable periods at every warning of an air raid.

There seems to be less anxiety as to the reliability of electricity in those countries that have had a more intimate experience of warfare conducted on their own territories. Thus, during a recent visit to the Brenner Pass, I observed that apart from the use of petrol lorries, which would have to run on narrow and sometimes steep roads, reliance for transport would necessarily be placed upon the electrified railways. The neighbouring towns also depend for their electricity on transmission lines that for the most part run under much more exposed conditions than prevail here.

If we must design our industrial works primarily with an eye to war conditions, let us, at all events, be sure that we do not, by wrong estimates of risks, handicap ourselves in our struggle for a leading position under normal peace conditions. TRACTOR.

August 28th.



This stator, weighing over forty tons, is now in transit from the Trafford Park works of the Metropolitan-Vickers Electrical Co., Ltd., to the Battersea power station. Special arrangements have had to be made for its transport, and the final stage of the journey, from Old Oak Common, near Paddington, to South Lambeth is being made this week-end

"Dishonest and Mischievous"

The leading article in your issue of August 24th on "Electricity Supply Policy," shows that the dishonest and mischievous use of the word "electricity" when "electric energy" is meant, has now reached a serious and dangerous stage. It is not a question of diction but of fraudulently inducing the public to accept for domestic heating and cooking, a certain quantity of thermal energy, which is falsely assumed to be more economical than the combustion of fuel-gas. This is and always has been common knowledge to all of us, and technical evidence is unnecessary. It is an urgent matter for suitable legislation.

But the general import of the article is based on this deception, and it is therefore my duty to protest against the whole of it. There are two very glaring errors, in paragraph 8, and paragraph 9, respectively. In paragraph 8 it is stated: "In Britain it is increasingly obvious that notwithstanding all that has been done the unsolved problems are still very great." When it is remembered that your columns were doing useful and honest work in the 'seventies, it is difficult to understand your present attitude towards what every engineer knows to be unnecessary waste of our great national asset, coal. This was put before the British Association in 1931, in connection with the Bramwell Trust, and it is also common knowledge that the i.c.e. did not receive due recognition.

Electricity is changed into energy by means of plant and fuel. The first essentials of the process are: Cheap plant, cheap fuel, highest possible efficiency, and minimum of labour. In obtaining these there are not any unsolved problems. Fortunately, Sir Alfred Ewing gave us the respective efficiencies of the i.c.e. and steam as 38.5 per cent. and 23.84 per cent., or 61.5 per cent. in favour of the i.c.e.

But the i.c.e. may be segregated and put electric energy into a common local main at so many points that distribution losses are reduced to the minimum, and any local plant failure is covered by the six surrounding plants without seriously interfering with the supply. It thus eliminates the grid, with all its auxiliary plants, transformations, and conductor losses. The municipal engineer takes the sole responsibility, as was provided for in the 1882 Act; bureaucratic interference with his work is needless and it should never have been permitted.

In paragraph 9, you say: "It has not always been the engineer or the manager who has been responsible for delayed improvement." I take leave to challenge this. Had all the engineers acted as I did at Ayr, consultants and companies would not have obtained their stranglehold on supply.

Lee, S.E.12, *August 25th.* E. G. PINK.

[Our correspondent leaves us speechless!—EDS. ELEC. REV.]

A Combined Pump and Starter Wanted

A consumer is inquiring for particulars of a small motor-driven air pump, for inflating the tyres of his car, combined with an electrical drive for starting the engine on those occasions known to all of us, when neither starter nor "sweat" produces results. A small h.p. motor with flexible drive would seem to be a suitable solution to the latter problem, but is there any far-sighted manufacturer who has a unit which meets both requirements? Needless to say, expensive apparatus will not be acceptable to the ordinary consumer.

Incidentally, from inquiries made, it would appear that the first car manufacturer to include a universal motor combined with the usual starter unit will reap a good harvest, even though the initial retail price may rise by £10 or so. Are there any serious technical difficulties in the way?

Marlow, Bucks, *August 22nd.* H. H. HARTLEY.

The Improvement of Domestic Appliances (*continued from opposite page*)

sive features in illumination, transform dull and otherwise stereotyped interiors into places of considerable charm and character. As electrical illumination is now irretrievably bound up with artistic decoration and furnishing, it may be advantageous to permit the sale of such apparatus as standard lamps and large shades to gradually migrate from the supply authorities' showrooms to those of the house furnishers and decorators, provided genuine interest is shown. The marketing of electric clocks could be similar and artistic designs produced to suit any particular furnishing scheme. Owing to the poor revenue producing capabilities of such appliances, supply authorities cannot be expected to evince any considerable interest in their sale.

Although great advance has been made in the illumination of the stairways and passages of large buildings by means of panel and ceiling lighting, these places in the medium and smaller sized houses have been comparatively neglected. Here the accumulation of dust is often considerable, yet owing to the difficult situation the desirable periodical cleaning cannot always be effected. Parchment and open type shades are therefore less efficacious than small totally enclosed ones.

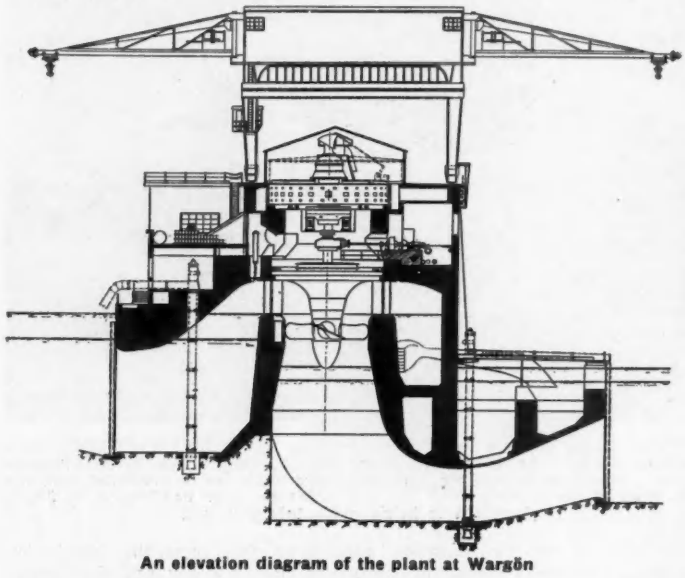
More care could be given to the avoidance of projections in the general design of appliances. Cooker controlling switches, door handles and connection plugs, etc., are the chief offenders. The position of the draining tap in the case of a wash boiler should be such as to permit the draining of the entire container and not leave two or three inches of water in the bottom. Cooker instruction cards should also be of a material that can be cleaned and will stand up to the general wear and tear of a kitchen and still remain readable throughout the life of the cooker. Thin cardboard is definitely unsuitable for this purpose.

Improving Sweden's Hydro-electric Output

Plan to raise the level of Lake Vänern

LAKE Vänern, in Sweden, is Europe's largest fresh water lake outside Russia. Its only outlet is the Göta River, of which the highest fall, some 32 metres, is at Trollhättan, where there is hydro-electric plant with an aggregate output of 130,000 kW.

In 1925 the State built a second station a short distance further down the river at Lilla Edet, where there is a fall of 6.5 metres, and installed three propeller-type turbo-generators developing together about 30,000 kW.



An elevation diagram of the plant at Wargön

The only other fall is upstream between Trollhättan and the lake at Wargön, where a dam was completed in 1931. The net head available initially was only 3.3 metres. This necessitated the use of a large volume of water, and consequently, the turbines and hydraulic works are of unusual dimensions. The machines have runners measuring over 8 metres (25 ft.) in diameter, and they are among the largest so far constructed.

The height of the dam is now to be increased, thus increasing the head available to at least 4.5 metres and also enabling the lake level to be raised for regulating the flow of water. Without this the building of the Wargön plant would have been too costly an undertaking.

According to *Swedish Export* each turbine will require about 280 cu. m. of water per second at a head of 4.3 m. on full load, and up to 330 cu. m. per second when on overload. A feature of the plant is that the turbines are at water-level with ducts constructed on the siphon principle, which has made it possible to dispense with intake gates.

Starting Methods

For starting the flow air is exhausted by means of ejectors. With one of the large ejectors in operation it takes about 2½ hours to evacuate one siphon at low water, and one hour at mean headwater level. For short shutdowns the water tunnels are not emptied, and the turbines can then be started immediately. No screens are provided as the spaces are considered sufficient to let through any floating objects. The concrete masses are of imposing dimensions and to avoid obstructing the flow there are no partition walls; in consequence the roof of the intake and suction ducts at some places has a span of up to 20 metres. There is no regular machine room, each generator being merely covered by a hood which can be lifted off by means of a crane.

This plant will be operated entirely from the Trollhättan station several miles away, including the throttling of the turbines, opening and closing the weirs and regulating the voltage. The two Kaplan vertical turbines together develop 19,400 h.p. at a head of 3.3 metres, 27,600 h.p. at 4.3 metres, and 32,400 h.p. at 5 metres. The velocity is only 46.9 rev. per min. Each turbine is connected to a three-phase generator of 12,000 kVA working at 11,000 V. One of the generators is designed for 25 cycles and is connected direct with the 11,000-V circuit at Trollhättan, whereas the other generator is wound for 50 cycles and its output is stepped up to 55,000 V for transmission.

The turbines were supplied by the Karlstad Mek. Verkstads A.B. of Kristinehamn and by Nydquist and Holm of Trollhättan, while all the electrical plant is of "Asea" manufacture.

Regulation will provide for a flow of water up to 900 cu. m. per second (maximum) and will permit the construction of a new canal from Wargön to Trollhättan, where a new 100,000-h.p. station is to be built. The higher lake level will correspond to an increase of not less than 850 million kWh, approximately 60 per cent. of the present normal output of the river, computed in electrical power. Water stored in summer will be used in winter when the supply from the North Swedish rivers is least, and reduce the demand for steam generated energy.

Popularising Electric Water Heaters. By J. Russell Hickmott

A LARGE number of supply authorities have remarkably attractive hire and hire-purchase terms for electric water-heating apparatus, and there is no doubt that in time every household will have electrically heated water available for all domestic purposes. Just how many years it will be before such a position is achieved depends a great deal on the supply authorities themselves. It is most important to realise that this particular business will have to be sought for.

One of the chief obstacles in the way of further progress is the average consumer's lack of interest, which is perhaps due to lack of adequate information. It is surprising how few consumers, despite considerable publicity, have an accurate knowledge of the value of an electric water heater. A number of consumers recently interviewed, having scanned an advertisement, "Constant Hot Water Always Available," were convinced that the elements of a water heater were continually in circuit. It was not a case of bad advertising, because if the whole announcement had been read the object of fitting a thermostat would have been clear.

As a matter of interest, I recently asked a number of schoolboys, who are being trained in electrical engineering, "What is an immersion heater?" and "What is an electric hot-water circulator?" The answers I received were, in practically every case, admissions that they did not know. On the other hand, every one was able to describe a gas geyser fairly accurately. It is very doubtful whether they had been taught the construction of a gas geyser at school, and it is, therefore, probable that they had picked up the knowledge themselves.

There is no doubt that when electric water heaters have become fairly universal the construction and operation of them will be common knowledge. For many thousands of boys attending technical classes in the country it would be a comparatively simple matter to arrange lectures on domestic electricity. The work could be carried out by the local supply authority, and I feel convinced that the authority would reap a rich harvest for its trouble. Also, the technical schools would, I believe, welcome a series of lectures by really technical men.

These lectures could also be given periodically in the local hall for the benefit of interested consumers. It is useless arranging demonstrations and expecting men to attend; a lecture is a different matter, especially if it is given in the evening and is well advertised as a semi-technical lecture. Many consumers are really interested in their appliances and are anxious to learn the most economical way of using them. An opportunity of asking questions would be welcomed if it was known that the informant was a technical man with considerable experience.

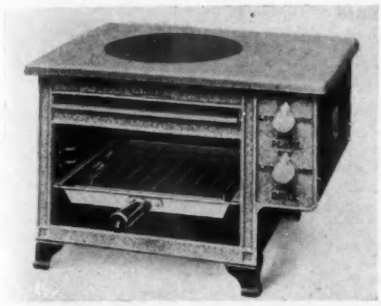
Consumers, I feel, have begun to realise that the canvassers and salesmen who call upon them are not, in the true sense of the word, technical men. I do not suggest that a fully qualified engineer should call on consumers in answer to an inquiry for a bowl fire or an electric cooker; no reasonable consumer would expect this. There is no doubt, however, that an opportunity to meet such an engineer occasionally would be appreciated and such contacts with the public should prove of considerable future advantage.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

An Improved Table-cooker

The improved "B.2" breakfast cooker produced by CARRON COMPANY, Carron, Falkirk, is of all cast-iron construction and has a separate 2,000-W boiling plate and a 1,500-W grill element unit. The latter can be released by a single screw at the side, permitting it to be withdrawn from the front. The hotplate is secured to the hob and lifts with this when the terminal wires are released. There are three adjusting screws on the spider for levelling.

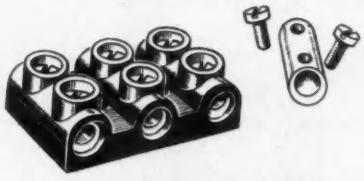


A Carron cast-iron breakfast cooker

The company believes that this model will prove even more popular among supply undertakings than the sheet-iron "B.2" cooker, largely because of the easier replacement of the components. The equipment measures 12½ in. by 18½ in. by 13½ in. overall, and with the hob and front frame finished in vitreous enamel the cooker is priced at £4 5s.

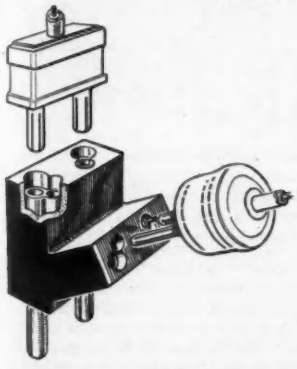
Bakelite Terminal Blocks

The accompanying sketch illustrates clearly the construction of the new Belling & Lee bakelite terminal blocks. The type shown is the large three-way size costing 2s. 6d., but the smaller size two-way costing 1s. 6d., and the small three-way, which is retailed at 1s. 9d., are designed on almost identical lines except that the terminals are close up against one another, the fixing holes being at each end of the block instead of in between the terminals. The makers' address is Cambridge Arterial Road, Enfield.



A Belling & Lee terminal block

Multi-plug Adaptors



The 5/15-A "Grelco" adaptor

The "Grelco" multi-plug adaptors have already been described in these columns. We now learn that the GRAFTON ELECTRIC CO., 54, Grafton Street, Tottenham Court Road, London, W.1, has placed on the market a combined 15- and 5-A type designed on similar lines but with sockets specially shaped to take the two sizes of plugs.

The angle permits the use of large round plug tops, while by building up one adaptor on another any number of sockets can be obtained provided the total current passing through the one nearest to the switch-socket does not exceed 15 A. The 15-A adaptor costs 2s. 6d.

A Bedroom Lighting Set

KNIGHTSHADES, LTD., 36, Queensway, Ponders End, Middlesex, inform us that they have just introduced a "matched bedroom set." This consists of a wooden table stand, ten inches high, wired complete with lampholder (12s. 6d.), a shade for the lamp, nine inches in diameter (3s.), a six-inch pendant (5s.) and a bedlight wired complete (12s. 6d.). The shades are all of cream moiré lumex which can be obtained tinted in pink, blue, green, orange or gold; the table standard is of delicately lacquered wood with chromium plated ornaments. When sold complete the set costs 32s. 6d.

Geared Fractional H.p. Motors

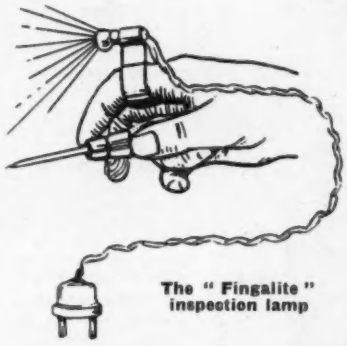
A recently issued leaflet, No. E.M.7, by CROYDON ENGINEERING CO., LTD., Gloucester Road, Croydon, describes a wide range of geared fractional h.p. motors. There are three distinct types of worm reduction unit available.

The type illustrated herewith is available for powers of $\frac{1}{10}$, $\frac{1}{8}$, $\frac{1}{4}$ and $\frac{1}{2}$ h.p. at any output speed between 60 and 440 r.p.m. and suitable for d.c., or one-, two-, or three-phase supplies. The gear box is cast integral with motor endshield and filled with special grease to ensure efficient lubrication, and the end cover is gland packed to prevent any egress of the lubricant. Ball bearings are used throughout and the worm wheel is of phosphor bronze. The worm, of hardened steel, is carried on the actual motor shaft, which is supported by a third ball bearing. A robust output shaft of nickel steel is also carried on ball bearings and can be supplied vertical or horizontal as desired.

A "Croydon" geared fractional h.p. motor

A Simple Inspection Lamp

An ingenious, and yet very simple, device is being manufactured by MESSRS. M. H. RICHARDSON, Bell Street, Wolverhampton, to provide a hand light for contractors. It is known as the "Fingalite," and can be easily fixed on to any of the operators' fingers, without causing any inconvenience when handling tools. An ordinary 4½-V flashlamp bulb is used, fixed in a suitable holder which encircles the finger and a length of flexible insulated wire leads to the battery which can be conveniently housed in a pocket.



The "Fingalite" inspection lamp

Providing an appropriate bulb is inserted the light may be worked off a motor-car lighting system. The makers can provide suitable adaptors for this method of operation.

The "Ozonelite" Fitting

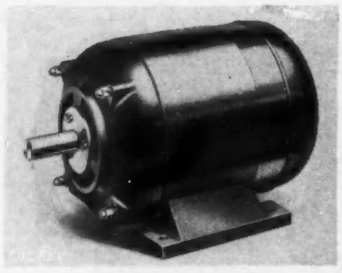
Ozonising in the home is often considered by the average householder to be an expensive luxury, but OZONAIR, LTD., St. Leonard Street, London, S.W.1, have marketed an apparatus (type 128) combined with an artistic table lamp at 15s. in bronze and 16s. 6d. in chromium, the shade being 8s. 6d. extra. Any design of shade may be used, although the one supplied by the company is designed to harmonise with the straight lines of the ozoniser itself. The standard is, of course, equally suitable for office use.

The "Ozonelite" table standard

Small Ball-bearing Motors

Recently a line of ball-bearing machines has been added to the comprehensive range of fractional horse-power motors made by the BRITISH THOMSON-HOUSTON CO., LTD., Rugby. The different types of B.T.-H. fractional h.p. motors now available include the a.c. capacitor, a.c. repulsion-start induction, a.c. split-phase, d.c. compound wound, a.c. and d.c. flameproof, a.c. and d.c. geared units, and a.c. and d.c. ball-bearing motors.

A special feature of the new motors is the choice of mounting. All standard ball-bearing motors up to ¼ h.p. are provided with feet cast solid with the end-shield, and above ¼ h.p. the machines have a pressed steel or cast base; further, all sizes can be supplied with alternative mechanical features. For instance, motors can be provided with feet or base and spigoted end shield, which provides a ready means of mounting customer's apparatus direct on the motor where the apparatus such as a pump or reduction gear is small enough to be carried by the motor.



B.T.H. fractional horse-power a.c. repulsion-start induction motor, fitted with a removable cast base

Alternatively, machines can be supplied without feet or base, but with a spigoted end-shield, which allows the motor to be built in, or carried on, a customer's machine. Another design of motor is built without feet or base and without spigot, this arrangement allowing the motor to be secured to the cradle formed by the driven machine, by four bolts screwed into holes provided in the frame, which can be mounted horizontally, vertically, or at any desired angle. This is particularly valuable where the contour of the whole equipment is important.

The new motors are available in sizes up to 1 h.p. for a.c. or d.c. circuits, the a.c. machines being of the split-phase induction and repulsion-start induction types, while the d.c. machines are of the compound wound type.

A Combined Clock and Table Standard

A combined table standard and synchronous clock is a new introduction of striking design by the BELGRAVE ELECTRICAL CO., LTD., 24, Belgrave Road, London, S.W.1. The stand and the back of the clock are chromium plated, as are also the hour, minute and second hands. The glass dial can be supplied clear or in translucent black with a black base (as illustrated), or with a peach-coloured dial and a walnut base. The light switch is of the push-button type and is situated in the base, while the starter for the clock motor and the knob for setting the hands project out of the casing at the rear of the clock. The price is £3 15s. 6d., wired and with the shade. An alarm movement can be fitted to the clock.

The new Belgrave clock-lamp

The Revo Domestic Programme

WE are able to give advance particulars of new domestic products which are to be placed on the market by the REVO ELECTRIC CO., LTD., Tipton, Staffs., during the autumn. Probably the most interesting from the point of view of design is the new washer.

The new Revo washer

Boiling, washing and wringing are all accomplished by the one machine, which is distinctly unusual in appearance. The outer casing is of heavy galvanised steel with a cast top plate and cast-iron legs of a modern design, protected by domed feet which provide a rigid support.

The water container is constructed of heavy-gauge copper, tinned inside, and fitted with patent water circulating vanes, a large-bore draining tap and a polished copper lid. The capacity is 14 gallons. Heating is accomplished by 4-kW Revo elements controlled by a three-heat switch situated in a pocket in the body of the boiler, and a ½-h.p. steam and watertight concealed motor operates the blower which is controlled by a simple "on" and "off" switch.

The wringer is hand operated and pivot-mounted to allow setting in two positions. The rubber rollers have a simple pressure regulator and all-enclosed gearing. The top plate is finished in vitreous mottled enamel and the body is mottled stove enamelled, with a galvanised under surface. The price of the equipment is £16 and the dimensions are 33 in. by 33 in. by 41 in. high.

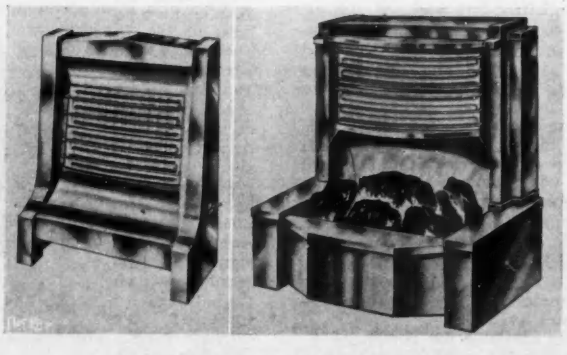
There is also a new series of hot-water urns ranging in size from one to ten gallons, with loadings of 2 to 3 kW. They comprise a heavy-gauge copper water container and lid, the elements being clamped to the base of the container, and can be supplied with or without a three-heat rotary switch let into the body of the urn. The handles and tap are made of brass and the finish is polished copper or nickel-plate. Prices range from £4 10s. to £14 5s.

A further introduction for the coming season is a 5-pint kettle. It is priced at from 37s. to 42s. with cable and connector, and can be obtained in polished copper or nickel-plate finish and with or without a safety device. A commendable point in the design is the quick-filling opening behind the moulded heatproof handle instead of, as is usual, under it.

The hot-water urn and 5-pt. kettle

Already at this early date the Revo Company is able to announce three new fires. The "Tubular" is made in a style which has hitherto not been developed by this company at all. The design is similar to some modern furniture—the frame consisting of a single chromium plated steel tube curved in such a way that it forms a suitable support for a parabolic reflector and special firebar which, it is claimed, is capable of projecting the heat in any desired direction. The price is 25s.

A new cast-iron fire on modern lines and entirely free from any decoration is the "Locarno," designed to be readily portable and stable. The two 1-kW bars are recessed and the fire can be obtained finished in oxidised silver, brass or copper, vitreous enamel or majolica enamel at from 25s. 6d. to 35s. The latest imitation coal fire is the "Cubist" which is built up of sheet metal and cast iron and houses two 1-kW firebars in the canopy over the fuel. A flicker device is incorporated and the finishes obtainable are sprayed oxidised brass, silver or copper, at £2 15s., or florentine bronze at £3 5s. Two earlier fires, the "Exelda" and "Matchless," are now obtainable with a chromium finish.



The "Locarno" and "Cubist" fires

The Forthcoming Lighting Season

Useful publicity aids devised by lamp makers

TO increase their sales during the forthcoming season lamp manufacturers have prepared a variety of attractive publicity material. On this page we briefly review the programmes of a few leading concerns, showing that generally speaking, colour and brightness of design are being accentuated while several novel displays have been introduced.

A few examples of the publicity matter offered to dealers by the lamp manufacturers

Successful selling aids of last year are retained, and with the new material provide the dealer with a choice of cleverly-designed publicity matter which should lead to increased sales.

The Crompton-Kye lamp sales promotion campaign includes the distribution of the Crompton actinometer, an interesting and useful scientific instrument. By the aid of this meter a householder is able to judge whether there is sufficient light for reading, writing and other purposes at any point in the house. A small piece of sensitised paper is placed in the actinometer, and the time taken for the paper to darken to the same shade as the test tint which surrounds it is noted. From a table the value of the light is ascertainable.

The range of Crompton lamps has recently been extended by the introduction of a traffic control signal lamp with a filament of "double wreath" construction. This filament provides a light source of almost completely circular form, ensuring even distribution on the lens and a sharp focus.

The standard domestic and the high-wattage lamps for industrial and other applications are being backed by an extensive Press and poster advertising campaign. The Kye 1s. British lamp, which was introduced last year, will again be prominent. The publicity matter features a new and amusing advertising figure, "Canny McKye," who finds that these lamps "save the bawbees."

Other material includes a strongly constructed bronze-finished sheet-metal counter display stand to hold twelve lamp cartons enabling a small stock of lamps to be kept conveniently at hand.

"Aglow with Life!" is the slogan that forms the theme of the Metropolitan-Vickers campaign and this is illustrated by the head of an attractive girl radiating light from behind a cloud. This "Goddess of Sunlight" appears on the advertising material in the trade Press, on display matter and in publications, thus forming a link between the various advertising aids.

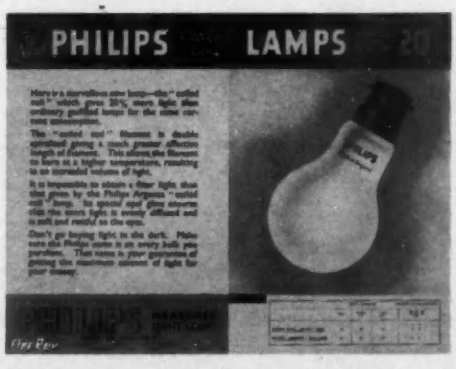
An envelope enclosure which is supplied overprinted is a colourful leaflet of novel design and contains the prices of all general purpose "Cosmos" lamps, including the new coiled-coil lamp, motor bulbs, and architectural, decorative, "Thriftlite" and other useful lamps. Another leaflet is available dealing with the "Shrine" and "Remembrance" lamps.

The "Cosmos" lamp catalogue deals with the whole range of these lamps, and contains much information useful to the electrical trade. It is printed in two colours, with a bright four-colour cover, and it is corded for hanging up.

Small "stickers" (1¼ in. by 2¼ in.) for attaching to envelopes, &c., are supplied printed in four colours with the "Cosmos" girl design, and ready gummed for use. For windows, trade counters and showrooms appealing and serviceable display units, signs and showcards are available. The display unit is self-erecting and forms its own packing case. The signs are for hanging or standing. Both types are made so that the light from the lamp is available for general window illumination as well as for lighting the front panel, which contains translucent embossed lettering and lamps.

An attractive aluminium type of showcard featuring the "Cosmos Girl" is available, the radiant effect being greatly enhanced by the bright reflections from the metal. Illuminated electric clock signs are also provided, the clock mechanism being of the Metrovick synchronous movement.

The introduction of the coiled-coil lamp has largely influenced the 1934-35 publicity of the British Thomson-Houston Co. This new lamp is included in the different catalogues and leaflets and an attractive showcard is available.



Philips draw attention to the coiled-coil filament lamp

This season's B.T.-H. catalogue has more pages than any previous issue, and also deals with a number of lamps not

hitherto listed, including the coiled-coil lamp and the "Mercra" discharge lamp. The cover design is again based on the "Mazda" dancing girl showcard, but with a considerably modified colour scheme. The catalogue is conveniently thumb-indexed throughout.

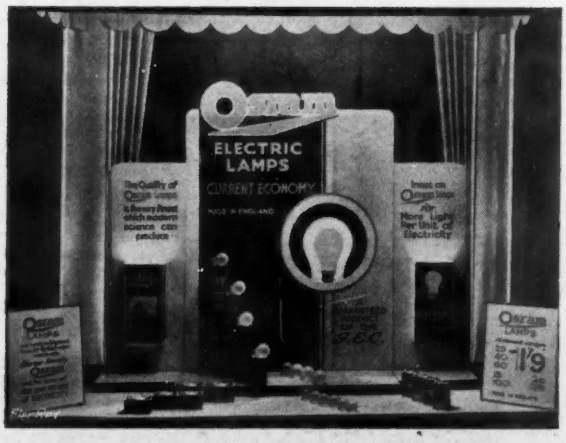
This little actinometer issued by Crompton-Kye Lamp Sales, Ltd., provides a simple rough and ready means of testing the adequacy of lighting in a room. A piece of sensitised paper is used in conjunction with a test tint and a table is given showing how long it should take for the paper to match the tint when exposed

During its three years of issue, the "Mazda Lamp Business Guide" has become very popular and this year it is larger than hitherto. A new feature of the guide is a schedule of foreign passenger cars sold in this country, giving in each case the voltage of the lighting set and the types of lamp caps used.

Other publications include a small card dealing with lamps for domestic use, a price-card relating to the coiled-coil lamp, and an attractive folder on motor-car lamps. Two new items of considerable interest in the latter leaflet (No. L.585) are the cadmium yellow bulb, first put on the market a few months ago, and the "safety first" hand-lamp transformer which eliminates all risk of shock and has certain other valuable advantages.

For general use a new version of the "Mazda Girl and Lamp" cut-out has been issued. For several years the B.T.-H. has made a practice of printing a full list of prices on its automobile lamp showcards. On the showcard for 1934-35 this has not been done, and the whole area of the card has been devoted to a design which includes a reproduction of the dancing girl mascot.

An intensive campaign for increasing sales is projected by Siemens Electric Lamps and Supplies, Ltd., who look forward with confidence to the 1934-35 season. The display material includes handsome oval hanging glass tablets with embossed red and silver lettering. The well-known "Popular Pair" children appear in a new setting, dressed in pyjamas on an



The window display provided by the General Electric Co., Ltd.

attractive showcard which carries the slogan "Bring Brightness into the Home." A counter cut-out is provided with a slot for holding price lists, while a remarkably effective window display comprises a modern villa, the "Popular Pair" seated on each side of a lettering panel with "Big Ben" in the background. Overprinted price lists also constitute a valuable sales aid.

The General Electric Co., Ltd., is making a special feature of the coiled-coil filament lamp and one of its showcards bears a representation of the new filament which is claimed to give 20 per cent. more light for the same energy consumption. Messrs. Os and Ram, the whimsical characters who became very familiar to the public last season, are again making their appearance in extensive newspaper advertising throughout the country.

Some attractive folders and showcards have been produced; one of the latter has a rainbow design as a background for an "Osram" lamp. A special window display has been arranged for dealers. This is in two sizes—for windows ranging from 5 ft. to 8 ft., and for windows over 8 ft.

The Nox Electric Lamp Co., Ltd., has designed a neat new carton for its lamps embodying a herald design and illustrations of the various types made by the company. We have also received examples of ash-trays in the form of half-lamps and a useful smoker's pocket knife bearing the company's advertisements.

The "Current Thief" (who dwells in cheap and inferior lamps) is again prominent in the publicity of Philips Lamps, Ltd. Amusing window bills with rhymed couplets warn the reader against him and a "Wanted" notice as used by the police, calls for his apprehension. Other matter relates to the coiled-coil lamp which the company, in common with other E.L.M.A. concerns, is introducing to the market.

Two handsome stands, which we illustrate, are a prominent feature of the material provided by the Edison Swan Electric Co., Ltd. They advertise "domestic" lamps and automobile bulbs. The former is 28 in. high and is made of plate glass, etched in parts, backed by red and blue neon tubing. The base is in oxidised gilt and bears the Royal Warrant signs. The sign dealing with automobile lamps has a red neon safety-first device with blue lettering.

The two handsome neon stands which the Ediswan Company has produced for the use of retailers

The company is distributing complete parcel displays containing a cut-out centrepiece, showcards, cartons and crêpe paper, with full instructions to enable dealers who require a complete window display to arrange this without the aid of a professional window dresser.

Synthetic Resins

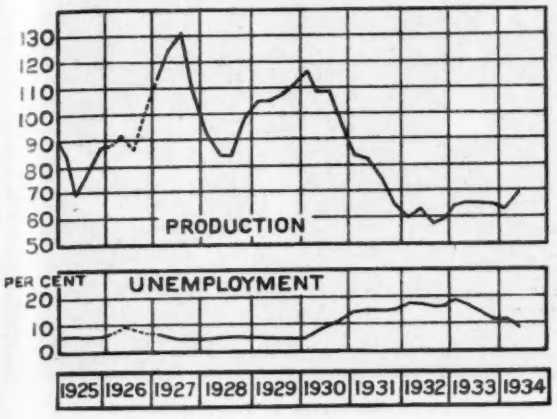
IN the course of his report for the year 1933-34, the Indian Trade Commissioner in London refers to the effect of the use of synthetic resins on the Indian lac industry. He says that a highly placed and competent authority has recently put the expansion of the phenolic groups of synthetic resins in the United Kingdom at 20 to 25 per cent. in each of the two years 1932 and 1933. The whole of the industry is in a very sound position and new uses, new processes and new products are literally almost of daily occurrence. A satisfactory development in the past year has been the extending uses made of natural products in combination with synthetic resins. With intensive lac research safely launched the future of lac is definitely bright, notwithstanding the progressive shrinkage in its use in the largest lac consuming industry, namely, the production of gramophone records. Efforts being made in India to market lac products of high quality and reliable composition and in the distributing organisations to secure some measure of stability in price will add appreciably to the brightness of the outlook. For the competition of substitutes has come to stay, the invention of a synthetic shellac as against mere synthetic substitutes may become a reality any day, and consequently the future of shellac cannot be assured save at the cost of sleepless vigilance and close co-operation between producer, distributor, and research worker.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures

Electrical Engineering Production and Employment

The accompanying curves, reproduced from the *Ministry of Labour Gazette* for August show the course of production and unemployment in the electrical engineering industry from 1925 up to the June quarter of this year. The basis employed is the level of 1924 (=100). It will be seen that production reached its highest point in 1927, when it was 30 per cent.



Curves showing the course of production and unemployment in the electrical engineering industry

above the 1924 figure. It then fell until the middle of 1928, when a further rise took it to 116 in the first quarter of 1930. Thereafter there was a severe decline the lowest point being reached in 1932, when production was only about 57 per cent. of that of 1924. A gradual rise then set in which is being continued. The lower curve shows how the unemployment figure rose and fell with the decrease and increase of production; the prevailing tendency seems to be a favourable one.

Employés' Representatives on London J.E.A.

The Minister of Labour gives notice that as soon as may be after September 17th he will designate to the London and Home Counties Joint Electricity Authority the employés' organisations having members in the employment of authorised undertakers in the district, so that the organisations may choose two representatives of persons employed in connection with the supply of electricity in the district to be members of the Joint Authority. Any employés' organisation which is desirous of being considered by the Minister for designation should make application in writing to the Minister not later than September 17th on the form provided for the purpose. Copies may be obtained from the Secretary, Ministry of Labour, Montagu House, Whitehall, London, S.W.

Enterprise at Worksop

The achievements of the Worksop Electricity Department have proved a stimulus to further enterprise, as is shown by a reprint of a front-page advertisement in the *Worksop Guardian* which we have received from the borough electrical engineer. This strikingly sets forth the case for electric cooking and removes any misapprehensions which might exist about the cost of the method. Some twenty-five consumers write enthusiastically of the satisfaction they have derived from electric cooking, at least three declaring that they can manage on a shilling a week, in one case for a family of eight. During the year ended March last the department fixed 170 cookers and grillers, while in the four succeeding months a further 164 were installed, the number in July being forty-nine. For cooking, electricity is supplied at ½d. per kWh, plus 3s. per quarter for hire of cooker, or 1d. and no cooker hire charge.

A Report on Yugoslavia

The Department of Overseas Trade has published a report on economic conditions in Yugoslavia by Mr. H. N. Sturrock, Commercial Secretary to the British Legation at Belgrade (Stationery Office, 2s. net). Mr. Sturrock says that in spite of a balanced Budget and a favourable trade balance all is not well with the country, which is now feeling the full effects of international depression when some other countries are enjoying slightly improved conditions. Both imports and exports increased in 1933, although imports of electrical goods were considerably lower. The total weight was 7,440 tons (against 8,488) in 1932, while the value fell from 107,138,000 dinars (£595,000) to 80,470,000 dinars (£447,000). Of the 1933 electrical imports Great Britain was responsible for only 1,163,900 dinars' worth (£6,500). Although Yugoslavia possesses abundant water power which is suitably distributed for electrification purposes comparatively little has so far been undertaken, owing to lack of capital. In 1932 there were 327 electric power stations owned by public bodies. Of these about 75 per cent. supplied only a single (town or village) community, and less than 4 per cent. supplied ten or more communities. At the same time there were 291 private and industrial power stations. The total capacity of these 618 stations was 446,679 kW, of which 304,574 kW was in public stations. Out of the total of 6,575 town and village communities, only 973 are supplied with electricity. Of the total population of 13.9 millions, 3.9 millions live in places supplied with electricity, and of these it is estimated that only 10 to 15 per cent. make use of it. The publicly-owned power stations sold 553.1 million kWh in 1932, while privately-owned stations produced 302.2 million kWh. It seems likely that electrification will provide interesting opportunities for foreign capital in the future.

There are three broadcasting companies in the country serving a total of about 63,200 subscribers. There are fairly heavy duties on imported receiving sets. The United Kingdom has never secured a considerable share of this market.

Works Visit

On August 14th members of the Motherwell and Wishaw and District Electrical Society and friends visited the works of British National Electrics, Ltd., Newarthill, and spent a pleasant and instructive time in going through the various departments and viewing the operations.

Tea was served in the test room, and Mr. W. D. Brassington, the burgh electrical engineer and president of the society, thanked the company for its hospitality. He mentioned the fact that the burgh Electricity Department was supporting local industry by obtaining almost all its cooker requirements from British National Electrics. Mr. John Hepburn, the secretary of the company, replied.

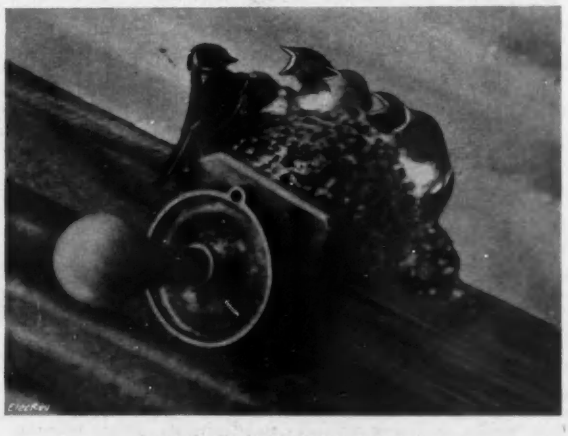
Irish Free State Electrical Imports

The imports of electrical machinery and cognate material into the Irish Free State during June last showed a slight increase, having attained a value of £68,790 as compared with £63,347 in the corresponding month a year ago. The appended table shows the imports during the first six months of the current and past years; as will be seen, there is a decrease in the total of £19,673 or about 5.5 per cent., due chiefly to the reduced imports of radio material.

	January-June, 1933.	1934.
	£	£
Electrical machinery	115,999	129,680
Electric wires and cables	35,797	48,919
Electric lighting accessories, fittings and parts	20,253	21,716
Radio sets and parts	101,614	56,361
Other electrical goods	103,470	100,784
Total	£377,133	£357,460

A Swallow's Good Example

We have received from Mr. H. Wilson, the electrical engineer to the Ashford (Kent) U.D.C., a postcard which he is circulating in his district. It bears the picture reproduced herewith and the words "This swallow had an all-electric house. Why don't you?" The bird built her nest behind a



A swallow's "all-electric house"

pattress on which an electric lamp was mounted over the works entrance of Messrs. Headley Bros.' Invicta Press, Ashford, and reared a family of healthy young swallows with the assistance of the light and heat which she obtained for

nothing. The electricity charges at Ashford are not so favourable as this but we believe that they are quite reasonable. Mr. Wilson thinks that the picture might be used by other supply engineers.

Recent Contracts

The English Electric Co., Ltd., has received an order from the Danish State Railways for the complete electric control equipment for twenty motor coaches and ten trailer coaches in connection with the electrification of the railway from Hellerup to Holte. The control equipment will be of the "all-electric camshaft" type, which is operating successfully on suburban systems in Madras, Bombay, Capetown, Vancouver, Japan, and in many other parts of the world. This repeat order follows the contract placed by the Danish State Railways in July, 1932, for the complete electric traction equipment for forty-two motor coaches and twenty-one trailer coaches, in connection with the electrification of the Copenhagen suburban lines.

Derby Cables, Ltd., has secured a contract for the manufacture and laying of approximately 12¼ miles of e.h.p. and l.p. paper insulated cable for the Worthing Corporation. The contract covers the supply of joint boxes, jointing and testing when completed, and the supply and erection of the necessary kiosks, feeder pillars and sub-station accessories. The total value is approximately £14,000. The object of the work is to loop into the existing e.h.p. ring main cable (11 kV) a new kiosk type sub-station at the "Horse and Groom" inn on the Worthing-Arundel road. It is expected that the work on the contract will begin within the next four weeks.

The electrode boilers and equipment for the Pioneer Health Centre, Peckham, to which brief reference was made in our issue of August 17th, are being supplied by Messrs. Bastian & Allen, Ltd. As stated, besides electric heating, hot water service and air conditioning, the Centre will have a swimming pool also heated electrically.

The contract for lighting fittings for the new block of flats which is being built at 60, Park Lane, London, W., has been secured by Messrs. Edward Trower & Co., Ltd., Knightsbridge, London, S.W.3.

Wages in the Cable Making Industry

The Joint Industrial Council for the Electrical Cable-making Industry informs us that there will be no "cost of living" alteration in wages in the industry on the third pay-day in September.

Social Events

Record attendance, record weather and record entries were the features of the County of London Company's eighteenth annual horticultural exhibition and garden party, held last Saturday at Raynes Park. There were 166 horticultural entries as compared with 96 last year, and in spite of the drought the quality was remarkably fine. The Lady Renwick Memorial Challenge Cup was won by Mr. W. Simpson (City Road) for the first time, and the Harry Renwick Memorial Cup was at last wrested from the Head Office by the Balham and Wandsworth team. Mr. Stagg (Camberwell) now holds the Sir Bernard Greenwell Challenge Cup and Mr. Robinson (Romford) won the A. R. Bacon Cup. The prizes were presented by Mrs. Brand. There were, in addition to the exhibition, various sports, amusements for the children, concerts, dancing in the evening and a fireworks display.

Large Orders for Cable

British Insulated Cables, Ltd., has received an order from the Chinese Government for hard drawn copper line wire to be used on the Nine-Province and Kiangsu toll line schemes. The total weight of copper is 1,700 tons and the mileage just over 16,000. Another order from the same source is for a butt welder for tubes up to 5¼ in. diameter. Other overseas orders which the B.I. has in hand include 27 miles of telephone cable and 200 tons of hard drawn copper line wire for the South African Government, and 63 tons for the South African Railways. The Durban Corporation is changing over part of its tramway system to trolley bus working, and the B.I. has obtained the order for the special overhead fittings required. At home, an order was recently placed with the company by the Grimsby Corporation for 27,000 yards of 0.10 sq. in. 22-kV 3-core screened-type cable. Our photograph shows this leaving the company's works.

A Cable-coupling Competition

To the ordinary Englishman an eisteddfod is a festival of song and poetry, of bards and druidical ceremonies. Nowadays, however, all kinds of unpoetical events are included in these contests—even cable jointing. Our illustration shows Messrs. E. J. Johns and W. H. Llewellyn, of the Cefn Coed Colliery, who won the first prize at Neath Eisteddfod for the best and quickest connection of a cable to a cable fitting. The type of fitting chosen for the competition was the Ellison cable-end coupling which is used largely by the Amalgamated Anthracite Colliery Co., the owners of the Cefn Coed Colliery.

Cable-coupling at a Welsh eisteddfod

Trade Announcements

Fescol, Ltd., 101, Grosvenor Road, London, S.W.1, has opened a branch establishment at Prospect Works, Lockwood, Huddersfield, with plant capable of dealing with shafts up to 6 ft. long of a weight not exceeding 2 tons.

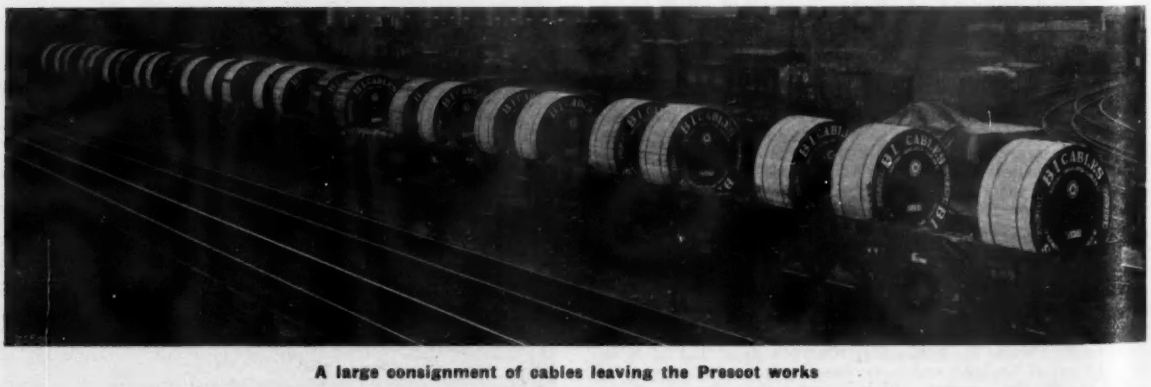
On and from September 1st the hours of business at the head offices and warehouse of Messrs. Brown Bros., Ltd., at Great Eastern Street, E.C.2, will be: Monday to Friday, 8.40 a.m. to 6 p.m.; Saturday, 8.40 a.m. to 1 p.m.

Creosoted Timber

British Insulated Cables, Ltd., inform us that they have a creosoting plant at their Prescot Works from which they can supply stay baulks, kicking blocks, cover boards, troughing, cattle guards and similar articles in timber creosoted to British Standard Specification or to customers' requirements, including the Rüping process.

A Manual of Radio Testing

The Automatic Coil Winder & Electrical Equipment Co., Ltd., has published a useful book entitled "Radio Servicing Simplified." This gives a survey of modern radio testing in easy phraseology, and should prove useful, not only to the trained service engineer, but also to the non-technical amateur. It can be obtained from the company at Winder House, Douglas Street, S.W.1, at 2s. 6d. (2s. 9d. post free).



A large consignment of cables leaving the Prescot works

Display of Lighting Fittings

A display of 1935 lighting fittings is being held by Messrs. E. Trower & Co., Ltd., at 2, Basil Street, Knightsbridge, London, S.W. The glassware is almost entirely of exquisite "Lalique" design and possesses remarkable light-transmitting

qualities even when it is two or three inches thick as in the "fleur carrée," or when coloured in one of the many agreeable tints. Hundreds of panels, pendants, bowls, &c., at very reasonable prices are exhibited. The display is open until September 7th.

I.F.S. Electric Lamp Duty

The Irish Free State Government has issued an emergency order imposing a duty of 75 per cent. on imported filament lamps, irrespective of the country of orgin. The *Financial News* states that this varies the duty already in existence, which consisted of 20 per cent. on lamps manufactured in Britain. Exceptions to the new order are hand battery lamps, or lamps for scientific or medical purposes.

The Southport Flower Show

At the Flower Show held in Southport last week prominence was given to apparatus for the heating of soil by means of electricity. Demonstrations of self-regulating electric soil-heating cables were given on the stands of Messrs. P. Tomlinson & Sons. Opportunity was taken by the Southport Corporation Electricity Department to show how electricity could be employed to promote the commercial success of the florist and market gardener.

Australian Tariffs Inquiry

Among the items included in the November-December programme of inquiries of the Australian Tariff Board are electric washing machines.

The Scottish Radio Exhibition

This year's Scottish Radio Exhibition which opens to-day (Friday) in the Kelvin Hall, Glasgow, is on a much more comprehensive scale than last year. All the features of the exhibition at Olympia are on view. The General Post Office and the British Broadcasting Corporation are giving their support, the former by staging an interesting exhibit of its various activities, and the latter by co-operating with the Radio Manufacturers' Association in the presentation of well-known B.B.C. artistes in variety performances.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances :—

CHEMICALS, ETC.	Price. August 29th.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£40	—
a Ammonia, Muriate (large crystal) ... ,,	£38	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£19 15s.	—
a Potash, Chlorate ... ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac T.N. ... ... per cwt.	£4 18s.	—
a Sulphur Commercial... ... ... per ton	£11	—
a ,, Roll ... ... ,,	£11	—
a Soda Chlorate ... ... per lb.	3¼d. to 3¾d.	—
a ,, Crystals... ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. nett.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil... ... ... ,,	1/2 to 2/9	—
p Babbits Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£205	—
Grade II ... ... ,,	£140	—
Grade III ... ... ,,	£67	—
c Brass (rolled metal 2" to 12" basis)... per lb.	6¾d.	—
c ,, Tubes (solid drawn) ... ... ,,	8¼d. to 9d.	—
c ,, Wire, basis ... ... ,,	7¼d.	—
c Copper Tubes (solid drawn)... ... ,,	9¼d.	—
g ,, Bars (best selected)... ... per ton	£58	—
g ,, Sheet ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£32 5s.	—
g ,, ,, Sheets ... ,,	£31 to £31 15s.	10s. to £1 dec.
d ,, ,, Wire Rods ... ,,	£38	—
d ,, ,, H.C. Wire ... per lb.	6¾d.	—
f Ebonite Rod ... ... ,,	1/3 to 1/6 plus	—
f ,, Sheet ... ... ,,	1/3 to 1/6 + 10%	—
n German Silver Wire ... ... ,,	2/5	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para fine ... ... ,,	5¾d.	¼d. dec.
i Iron, Pig (Cleveland No. 3) ... per ton	62/6	—
i ,, Wire galv. No. 1, P.O. qual. ... ,,	£20	—
g Lead, English Pig ... ... ,,	£12 10s.	5s. dec.
g Mercury ... ... per bot.	£11/7/6 to £11/12/6	—
c Mica (in original cases) small ... per lb.	6d. to 3/6	—
e ,, ,, medium ... ,,	4/- to 8/-	—
e ,, ,, large ... ,,	8/6 to 17/6 & up	—
p Phosphor Bronze, plain castings ... ,,	1/1	—
p ,, ,, drawn bars & rods ,,	10¾d.	—
p ,, ,, rolled strip & Sheet ,,	10¼d.	—
p ,, ,, wire ... ... ,,	11¼d.	—
o Platinum ... ... per oz.	£7 15s.	—
d Silicium Bronze Wire ... ... per lb.	7¾d.	—
r Steel, magnet, in bars ... ... ,,	7¾d.	—
n Tin, Block (English) ... ... per ton	£227 5s. to £229 5s.	£3 10s. dec.
g ,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	—

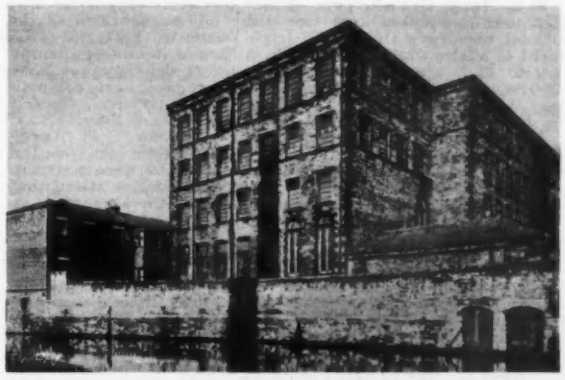
Quotations supplied by :—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. R. Dennis & Co.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead and rubber, up to the time of going to press, are given in our "Business Notes" under the same heading.

Bakelite Production at Blackburn

The accompanying illustration shows Highfield Mills, Blackburn, formerly used for the manufacture of cotton fabrics, which have been taken over by Novodyne Products, Ltd., for



The bakelite factory of Novodyne Products, Ltd., at Blackburn

the production of bakelite mouldings for the trade. The factory has a floor space of over 50,000 sq. ft. and is well situated. The Leeds and Liverpool canal runs along side the premises, which are within easy reach of the principal railway lines and junctions.

Lamps from Japan

A report from the Import Duties Advisory Committee, dated October 4th, 1933, recommended increased duties on electric lamps, has been published by H.M. Stationery Office (Cmd. 4686, price 1d.). The increased imports of these goods in recent years have come mainly from Japan, and since this report was received H.M. Government, after consultation with the United Kingdom Electric lamp manufacturers, have discussed with representatives of the Japanese Government the question of the imports of electric lamps from that country. As a result of these discussions it has now been decided not to give effect for the present to the recommendations of the Import Duties Advisory Committee, provided the imports of electric lamps from Japan during the year commencing April 1st, 1934, do not exceed the following totals : Lamps of 20 V and over, 4,300,000. Lamps under 20 V : Motor vehicle lamps, 5,600,000; flashlight lamps, 22,800,000; other lamps (fancy lamps), 1,100,000.

Changes of Name

Rentals, Ltd., radio and electrical manufacturers, have changed their name to Rentertainments, Ltd.

The Rhondda Tramways Co., Ltd., has changed its name to the Rhondda Transport Co., Ltd.

New Catalogues and Lists

Smith & Grace, Thrapston, Kettering.—Catalogue of V-rope drives.

Warmo Heating Co., 48, Mortimer Street, London, W.1.—A catalogue of "Warmo" radiators.

British Insulated Cables, Ltd., Prescot.—A leaflet on "Rockbestos" A.C.C.A. flexible and B.I. earthing rods.

Coronation Wholesale Distributing Co., Ltd., Eagle House, Jermyn Street, London, S.W.1.—Particulars of the "Herald" lamp clock and time-switch.

B.E.N. Patents, Ltd., Gorst Road, London, N.W.10.—Details of the "S" type spray gun.

Belgrave Electric Co., Ltd., 24, Belgrave Road, London, S.W.1.—A catalogue of pendant lighting fittings.

Hume Atkins & Co., Ltd., Pixmore Avenue, Letchworth.—A brochure on decorative lighting fittings.

Ward & Goldstone, Ltd., Frederick Road, Salford, 6.—A copy of the company's latest bakelite list.

W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, London, E.C.1.—A pamphlet describing a new electric vulcaniser.

Asea Electric, Ltd., 5, Chancery Lane, London.—A leaflet dealing with "Century" motors.

Ray Mouldings, Ltd., Empire Works, Exhibition Estate, Wembley.—Particulars of a combined lamp and shade holder without a shade ring.

Drake & Gorham Wholesale, Ltd., 77, Long Acre, London, W.C.2.—A 1935 radio catalogue.

Drayton Regulator & Instrument Co., Ltd., West Drayton.—A leaflet on edgewise ring balance instruments for indicating low pressure vacuum and draught.

English Electric Co., Ltd., Stafford.—A catalogue of fires for the 1934-35 season.

General Accessories Co., Ltd., 18-22, Euston Buildings, London, N.W.1.—A complete catalogue of electrical accessories.

Bankruptcy Proceedings

J. C. Law, Alma Villa, Mark, Somerset, electrical and radio engineer.—A deficiency of £72 was shown in the statement of affairs of this debtor when he appeared on August 23rd at the Official Receiver's Offices, 26, Baldwin Street, Bristol, for the first meeting of his creditors. It was reported that the business, which consisted mainly of battery hiring and electrical wiring, was successful until September, 1932. The matter was left in the hands of the Official Receiver as trustee of the estate.

D. C. Hayes (trading as the Streetsbrook Electrical Co.), 44, Burman Street, Shirley, Warwickshire, electrical contractor. —The first meeting of creditors was held on August 23rd at the

Official Receiver's Offices, 159, Great Charles Street, Birmingham. The statement of affairs showed gross liabilities of £2,240 and a deficiency of £1,045. Debtor attributed his failure to insufficient capital, bad position of his shop, bad trade, and heavy law costs. The matter was left in the hands of the Official Receiver as trustee.

C. E. Tong, 6, Fishergate, York, electrical engineer.—The first meeting of creditors was held on August 23rd at the Official Receiver's Offices, 17, High Ousegate, York. A statement of affairs was submitted which showed liabilities amounting to £207, against assets of £27, and a deficiency of £180. Debtor attributed his failure to lack of capital, keen competition, and ill-health. The case, being a summary one, was left in the hands of the Official Receiver as trustee of the estate.

M. J. Wallage (trading as "Wallage & Sons"), 68, Rugby Road, Brighton, electrical dealer.—The public examination was held recently at Brighton. The liabilities were stated to amount to £154, and there were no assets. Debtor stated that in June, 1926 he started business on his own account. In November, 1930, he purchased the fixtures and fittings of a shop for £25. A company was then formed and the debtor acted as managing director. The business was successful at first, but it was eventually wound up. He had since started in business again as an electrical dealer, but without success. The failure was attributed to want of capital, a motor accident, illness of debtor's wife, and keen competition. The examination was adjourned for closing.

D. G. Morris (trading as Brynmor Radio Depot), Sea View, Pembrey, Carmarthenshire, radio and electrical engineer.—The receiving order herein was made on the debtor's own petition, and at the first meeting of creditors held recently at the Official Receiver's Office, 4, Queen Street, Carmarthen, the case, being a summary one, was left in the hands of the Official Receiver as trustee of the estate.

C. S. Ellis, 11, Kay Street, Darwen, electrical and wireless dealer.—This debtor's public examination was closed recently at Blackburn. It was stated that the estate showed a deficiency of £36. The failure was attributed to shortage of capital, bad trade, and loss caused by the sale of stock under an execution.

R. B. Emerson, electrical engineer, 330, London Road, Westcliff-on-Sea.—Application for discharge to be heard at Southend Petty Sessions on September 20th.

F. F. C. Evett (Radiofans Services), wireless and electrical contractor, 28, Flottergate, Great Grimsby.—Receiving order made August 22nd on debtor's own petition.

C. Doherty, electrical contractor, 28A, New Cannon Street, Manchester.—First meeting August 31st at the Official Receiver's Offices, Byrom Street, Manchester. Public examination September 28th at the Court House, Quay Street, Manchester.

S. Simmons, electrical engineer, 189, Whalley New Road, Blackburn.—Trustee, Mr. J. W. Carter, District Bank Chambers, Blackburn, Official Receiver, released August 10th.

G. Shilvock (G. Shilvock & Son), electrical contractor, 197, Railway Terrace, Rugby.—Trustee, Mr. C. J. Band, 9-11, High Street, Coventry, Official Receiver, released August 10th.

D. L. Gibson (James Rush & Co., and the Hadrian Engineering Co.), wireless retailer and manufacturer, 31-33, Westgate Road, and Back Eldon Lane, Newcastle-on-Tyne.—Trustee, Mr. G. R. Mould, 2, Saville Place, Newcastle-on-Tyne, released June 27th.

W. H. Tweedle (Premier Radio and Electrical Supplies), radio engineer and dealer, Paddock Head, Paddock, Huddersfield.—Last day for receiving proofs for dividend September 8th. Trustee, Mr. J. O. Morris, 71, Manningham Lane, Bradford, Official Receiver.

H. C. Vanson, electrical engineer, 35, Pasture Road, Goole.—Receiving order made August 17th, on debtor's own petition.

Company Liquidations

Reading Electric Supply Co., Ltd.—Particulars of claims to Mr. G. W. Spencer Hawes, 16, Friar Street, Reading, the liquidator, by October 31st.

Light Controlled Installations, Ltd.—Particulars of claims to the liquidator, Mr. G. C. Jarvis, 115-117, Cannon Street, London, E.C.4, by September 18th.

Pettie & Co. (Electrical Engineers), Ltd.—Winding up voluntarily. Liquidator, Mr. T. E. Clarke, 34, Castle Gate, Nottingham.

Purit Specialities, Ltd.—Winding up voluntarily. Liquidator, Mr. W. R. Adams, Queslett, Parkhouse Road, Torquay.

Riddle & Goddard, Ltd.—Winding up voluntarily. Liquidator, Mr. H. S. Hardwick, 157, Rushey Green, London, S.E.6, appointed August 7th.

Fraser Radio, Ltd.—Particulars of claims to the liquidator, Mr. A. M. Hobbs, 64, Great Portland Street, London, W.1, by September 10th.

Receiver Appointed

H. G. Moseley & Co., Ltd.—Mr. R. S. King, Queen's College, Paradise Street, Birmingham, informs us that he was appointed receiver for the debenture holder on August 16th.

Deed of Assignment

G. A. House, 195, High Street, Deal, radio and electrical engineer.—Particulars of claims to Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, London, E.C.2, trustee, by September 4th.

Dissolutions of Partnership

The Zimmer Conveyor Co., electrical, pneumatic, and mechanical engineers, 82, Mark Lane, London, E.C.3.—Messrs. H. J. Christopher, A. F. Redman and H. Christopher have dissolved partnership. Mr. Redman will attend to debts.

Caledonian Wireless Co., 451, Caledonian Road, London, N.—Messrs. A. H. J. Sims and A. R. H. Smillie have dissolved partnership. All debts before July 30th will be paid by Mr. Sims and thereafter by Mr. Smillie, who will carry on the business.

Reduction of Capital

Furnival & Co., Ltd.—A petition has been presented for the confirmation of the reduction of capital from £50,000 to £2,000.

Electricity Supply

Lighting, Domestic, Power

Appleby (Westmorland).—ELECTRIC LIGHTING.—The Town Council has decided to light and heat the Town Hall by electricity instead of gas as at present.

Becontree.—SUB-STATION.—The County of London Electric Supply Co., Ltd., is to erect a sub-station in Hallbutt Street.

Bolton.—REVISED CHARGES.—The Electricity Committee has agreed to a two-part tariff for shop premises as an alternative to the existing rates of charge.

Bradford.—REDUCED HIRE CHARGES.—Reductions ranging up to more than 50 per cent. in hire charges in respect of a number of household electrical appliances have been made by the Electricity Department. The charge for wash-boilers has been reduced from 6s. to 2s. 6d. per quarter, and an additional facility is that, where required, wiring up to 30 ft. will be carried out for an extra charge of 1s. per quarter. The charge for circulator immersion water heaters has been lowered from 6s. to 3s. 6d. per quarter, and for storage tanks the quarterly charges are now as follows, the old charges being shown in parentheses: 1½-gall. capacity, 3s. 6d. (4s. 6d.); 3-gall., 3s. 6d. (6s.); 10-gall., York type, 5s. (6s.). In the case both of immersion water heaters and storage tanks the charge, as hitherto, includes wiring up to 30 ft. and plumbing. Kettles can now be hired independently of cookers. The hire charge for the 2-pint 1,000-W kettle is 1s. per quarter, and that for a special kettle, 1,800 W, 1s. 6d. Where required, wiring up to 30 ft. is done for 1s. per quarter extra.

Burghmuir.—PREPARATIONS FOR SUPPLY.—There is a demand for electricity in Burghmuir, a growing suburb of Perth, and the Grampian Electricity Co. is to submit a plan to the Perth Electricity Committee for a new transmission line for the Burghmuir district.

Burnley.—FRINGE ORDER.—The Electricity Committee has decided to apply to the Commissioners for a Fringe Order to supply electricity to the Enfield Brick and Terra Cotta Co. for new brickworks at Cliviger. The minimum requirements will be about 350 h.p. and approximately 400,000 kWh per annum will be purchased.

Cardiff.—CHANGE-OVER.—The Electricity Committee is to effect a further change-over of supply in the town centre at a cost of £10,000.

Coatbridge.—MERGER.—The electricity merger affecting Airdrie and Coatbridge is nearing completion. A Provisional Order enabling the Coatbridge Town Council to take over the undertaking of the Coatbridge and Airdrie Electric Supply Co. in Coatbridge has been approved. The Town Council will automatically transfer its responsibility to the Clyde Valley Electric Supply Co. It is expected that the Clyde Valley Co. will take over in Coatbridge early in October. Although the contract between Airdrie Town Council and the Coatbridge and Airdrie Electric Supply Co. does not expire till 1943, it is expected that arrangements will be made for the Clyde Valley Co. to take over in Airdrie also. A meeting to discuss electricity supply costs in Airdrie is to be held between Clyde Valley Co. representatives and the Airdrie Electricity Committee.

Dalbeattie.—INQUIRY INTO BREAKDOWN.—At a meeting of the Town Council a long discussion took place over the failure of the town's electricity supply in January last. Dissatisfaction was expressed regarding the County Council's inquiry into the failure. Bailie Sturgeon alleged that the wire had been deliberately cut, and moved that the matter be put in the hands of the Procurator Fiscal, and, failing satisfaction there, that they write to the Home Secretary. The Town Clerk stated that the cable belonged to the County Council, and he did not think the Town Council had the power to place the matter in the hands of the Procurator Fiscal. It was decided to await an official reply from the County Council before coming to a decision.

Douglas (I.O.M.).—PROMENADE ILLUMINATIONS.—The public lighting on the crescent-shaped Promenade has recently been greatly improved by the erection of ornamental steel standards with artistic "Ediswan" double brackets fitted with decorative lighting units containing 500-W gasfilled lamps at a mounting height of 24 ft., bringing the illumination up to classification "D" of the British Standard Specification. The standards are spaced about 30 yds. apart on each side of the Promenade, and carry parallel lines of decorative lighting festoons consisting of many thousands of electric lamps. Mr. Bertram Kelly, the borough electrical engineer and manager, informs us that the beauty of the scene at night time, especially when viewed from the sea, is so attractive that the Isle of Man Steam Packet Co. has arranged evening cruises by its new 2,500-ton turbine steamer, *Mona's Queen*, in order that visitors may see the full effect of these improved illuminations.

Downham.—SUB-STATIONS.—The South Metropolitan Electric Light & Power Co., Ltd., is to erect sub-stations in Moorside Road and Shroffield Road.

France.—ELECTRIC POWER PROGRESS.—Our Paris Correspondent reports that the figures for French production of electrical energy for the month of June have been made public, and show a considerable improvement over last year. The

total production was: steam plants, 298,112,680 kWh (296,575,334 kWh in 1933), and water-power plants, 572,272,050 kWh (516,158,128 kWh in 1933).

Electrical construction for the first seven months of this year has been at about the same level as for the same period last year. So far, none of the work included on the public works programme has been started, but the companies hope that a start will be made in about two months. Reports on the situation of the power companies in the south-west of France (Region of Bordeaux) show the continued improvement in the situation in that region. Electricity is largely produced by water power, and the extreme drought this year has somewhat increased the operating expenses of the companies which have been obliged to operate their steam plants to full capacity for the first time for several years, this in the face of an increasing load. In spite of this additional expense, the profits of the companies are slightly in excess of last year's. Construction of lines and power plant in this region seems for the time being to have reached its saturation point, and no new construction is expected in the next few years.

OVERHEAD POWER DISTRIBUTION.—The Compagnie Lorraine d'Electricité, of Nancy, has secured a concession to establish a 150,000-V electric power transmission line with a capacity of 55,000 kVA between Liebvillers (Doubs Department) and Ronchamps (Haute Saone), a distance of about 30 miles.

Gateshead.—SUB-STATION.—The North-Eastern Electric Supply Co., Ltd., is to erect a sub-station at the junction of Ashew Road and Ash Street, Gateshead.

Glyn Cieriog (Wrexham).—STREET LIGHTING.—The Parish Council is to ask the Electricity Company for an estimate for lighting streets during the coming winter.

Great Waltham (Essex).—SUPPLY EXPECTED.—The h.p. transmission line from Chelmsford to Felsted has just been completed, and the County of London Electric Supply Co. states that the work on the l.p. line to supply Great Waltham will be commenced as soon as the necessary permission has been obtained.

Hillingdon.—The Middlesex County Council is to provide X-ray equipment at Hillingdon County Hospital at a cost of £1,200.

India.—ELECTRICITY IN BIHAR.—In spite of the economic depression, the demand for electricity continues to increase in Bihar and Orissa, states our Bombay Correspondent. Two more important towns were given a supply during the past year and the total number of public electric supply corporations rose from six to eight. The sales in Patna rose considerably and, in spite of the reduction in rates, the profits of the company are on the increase. There was also an increase in the consumption of electricity in all other centres. Recently three more licences have been issued for supplying electricity for three towns.

TATA STEEL COMPANY POWER HOUSE.—The Tata Iron & Steel Co., Ltd., Jamshedpur, is to spend Rs.40 lakhs for the re-equipment of its power house, on which the whole of the works and those of many subsidiary companies depend for electric power. The Mysore Government has decided to spend Rs.2 lakhs for generating power at the Bhadravati iron works for the manufacture of steel, which is going to be undertaken as a new venture. The electrical equipment will be supplied by Siemens Schuckertwerke, Berlin.

Japan.—NEW POWER STATION.—The I.G.R. intends to erect a large power station on the Totsu River, at a cost of 20,000,000 yen, for the purpose of electrifying some railway lines in Osaka, Kobe and Kyoto, and has already applied to the Home Office for its approval.

ELECTRICAL DEVELOPMENT.—At the request of the Government, the producers of electricity were some time ago charged to make an inquiry with a view to bringing about a simplification, combination and a better state of distribution of electricity. In a report submitted to the Government the suppliers recommend the introduction of a five-year plan for the development of hydro-electric stations and the extension of the network under the control of, and with the financial assistance of the State.

Kirton Lindsey.—STREET LIGHTING.—At a recent meeting of the Parish Council there were fifty-three votes for, and only one against, a proposal to accept the offer of the North Lincolnshire & Howdenshire Electricity Co. for the street lighting in preference to that of the local gas company. A poll was demanded, the date for this being fixed for September 5th.

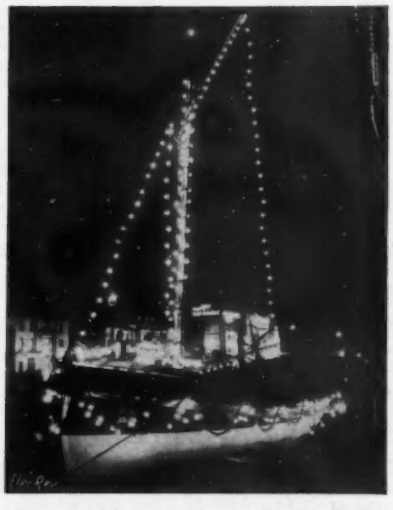
Leominster (Herefordshire).—CABLE LAYING.—The relaying of the cables in the streets has been commenced by the Shropshire, Worcestershire and Staffordshire Co.

London.—WANDSWORTH.—Not satisfied with the County of London Electric Supply Co.'s recent reductions in the domestic two-part and business electricity tariffs, the Consumers' Committee has asked the Borough Council to take steps to secure a reduction in the power charge (2¼d.) and lighting flat rate, which, at 5d. per kWh, is as much as 2d. per kWh more than in some of the neighbouring districts.

London County Council.—ELECTRICAL INSTALLATIONS.—The L.C.C. is to install electricity at further staff quarters of the fire brigade at a cost of £730.

Luton.—A COMPLAINT FROM AMPTHILL.—A request for a reduction in electricity charges has been received by the Town Council from the Ampthill Rural District Council. During the last three years no less than £12,500 has been allocated from the profits of the Electricity Department to the relief of the rates, in particular with a view to the building of the new town hall. The Ampthill Council considers that the money should have been devoted to the reduction of the electricity charges.

Motherwell and Wishaw.—REVISED CHARGES.—The Town Council recently adopted a scheme by the borough electrical engineer, Mr. W. D. Brassington, whereby cookers, water-heaters and wash-boilers will be available to consumers under the following conditions: An initial deposit of 10s., plus a charge of 1d. per kWh, the running rate to be collected by means of a prepayment meter. Only existing consumers are to be eligible. The scheme from its inception has met with success far beyond expectations. During the five months ended August 18th 448 cookers, 186 storage water-heaters, 143 immersion heaters and 47 wash-boilers have been installed. A prepayment 1s. coin meter, calibrated at 1d. per kWh, is installed with the apparatus. At each meter reading the amount in the meter is halved, 50 per cent. being for current consumed and 50 per cent. to pay off the cost of the apparatus. This system has the advantage of reducing to a minimum the work of keeping records. For purposes of assessing the capital charge, interest and maintenance, the Electricity Department bases its figures on a period of five years as being the average time taken by the consumer to pay for the equipment installed. The consumer is notified by the Department when his equipment has been paid for, and he then has to option of either keeping the existing equipment and dropping from 1d. to ½d. per kWh, or he can have new and modern types of apparatus installed and continue to pay 1d. per kWh. In this event there will be no installation charge, and the time required to pay will be much shorter.



This well-illuminated craft is the Blackpool lifeboat, which has been decorated in this way as a means of raising funds for the Royal National Lifeboat Institution

Newent (Gloucester).—STREET-LIGHTING CONTRACT.—The Parish Council has accepted a contract of £122 for street lighting.

Paignton.—SUB-STATION.—The Paignton Electric Light & Power Co., Ltd., is to proceed with the erection of a sub-station at the Collaton housing estate, Paignton.

Plymouth.—LOANS.—The Electricity Committee has obtained sanction to borrow £39,276 for mains and £39,885 for sub-station equipment and kiosks.

MAINS EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £2,500.

Prescot.—REDUCED CHARGES.—The Liverpool City Council is to reduce the charge for electricity in the Prescot, Huyton-with-Roby, and Whiston areas from October 1st to December 31st, from 6d. to 4½d. per kWh, and after 1940 the charges will be the same as those existing at Liverpool.

Romsey and Stockbridge.—OVERHEAD LINES.—The Rural District Council is offering no objection to the Wessex and West Hampshire Electricity Companies erecting overhead lines to Furzedown, King's Somborne, at Halterworth in Romsey Extra, and along Six Oaks Road, North Baddesley.

Ross and Whitchurch.—CHARGES FOR SERVICES.—Complaints received by the Ross and Whitchurch Rural District Council regarding the alleged exorbitant prices charged by the Shropshire, Worcester, and Staffordshire Electric Power Co. for the laying of electric mains to farms and other residences in rural areas led to the Council receiving a deputation from the company at its last meeting. The chairman (Mr. J. G. Protheroe) said that one of the complaints was that the company carried its mains to the villages, took what might be described as the " cream " of the village, and left the more isolated parts of the area alone. Other members related difficulties which had been reported to them, and Mr. Mair

(for the company) explained that the laying of cables underground considerably increased the cost of supply. Since the company took over the electrical undertakings in Herefordshire it had spent £125,000 in extensions and developments. This development was being continued, and at present the company was connecting up new villages at the rate of one per week.

Swinton and Pendlebury.—ELECTRIC LIGHTING.—The Urban District Council has entered into an agreement with the Lancashire Electric Power Co. for lighting the streets of the new housing estate at Cliveley.

Tredegar.—CHARGES FOR NEW SUPPLY.—It was announced recently that the charges for the new electricity supply would be as follows: Lighting, 5d. per kWh; power, 1½d. to 2½d.; heating and cooking, 1½d. An alternative tariff will also be available, and an additional charge of 1½d. per kWh will be made under the assisted-wiring scheme until the cost of the installation has been repaid.

Walthamstow.—STREET LIGHTING.—An interesting lighting installation with Siemens "Sieray" gaseous-discharge lamps has recently been carried out at Wadham Road by the borough Electricity Department. This road is being widened to 60 ft., and, when completed, the lighting standards will be spaced at 150 ft. in staggered formation. In spite of the existence of the line of trees on one side, the present road surface is brilliantly lighted, and there is practically no shadow. The lamps in use are 400-W type "W" gaseous-discharge lamps in type "DA4" lanterns, the mounting height of the light source being 23 ft. above road level.

Warrington.—SUPPLY TO DUNHAM MASSEY.—The Electricity Committee has approved a draft scheme for electricity supply to Dunham Massey for submission to the Electricity Commissioners.

Wellington.—CANVASS.—The West Midlands Joint Electricity Authority is making a canvass of part of the Wellington rural area, including the parishes of Wrockwardine, Admaston, Longdon, Walcot, Charlton, and Overley.

Wigton.—OVERHEAD LINE.—The Rural District Council is to offer no objection to the Mid-Cumberland Electricity Co. erecting an overhead cable through Silloth.

Traction

Algeria.—FURTHER ELECTRIFICATION.—The Algerian State Railways have allotted a sum of 200 million fr. for electrification during 1934-35. Conversion work is to be proceeded with on the Souk Ahras-Ghardimaou and Duvivier-Guelma lines, the second of which forms part of the Algeria-Tunis trunk route.

France.—PARIS SUBURBAN LINES.—In addition to the conversion work which is now proceeding on the line from the Luxembourg terminus to Massy-Palaiseau and Sceaux, a total of 12 miles, various other schemes are being considered for the extension of the Paris Métropolitain. The most important of these is a proposal to extend the electrified network out as far as Limours, 38 miles from the centre of Paris. It is estimated that extensions out to Neuilly, Bécon, and Montreuil would cost 300 million fr.

Japan.—RAILWAY ELECTRIFICATION.—The I.G.R. has decided to electrify during the next fiscal year three more State railway lines: the Uyeno-Matsudo section of the Joban line, the Shinagawa-Shin-Tsurumi freight section of the Tokaido line, and the Maihara-Imanoshe section of the Hokuroku line.

Russia.—RAILWAY ELECTRIFICATION.—According to the *Railway Gazette*, the Soviet Commissariat for Transport has announced the opening of an important line from Kusnezsk to Novosibirsk on the Trans-Siberian Railway, which will form the principal outlet for the coal mined in the Kuss Basin. According to the provisions of the second Five Year Plan, this 180-mile double-track line is worked electrically on the 3,000-V d.c. system.

A final survey is now being made of the route to be followed by the new electric railway between Kartali and Akmolinsk, in Siberia. This 390-mile line will unite the Karagandinsk Basin with the Magnitogorsk metallurgical works and other industrial enterprises in the Urals. The Kartali-Akmolinsk line will eventually form part of the South Siberian railway, running from Kartali to Semiplatinsk on the Turksib railway. Electrification work is now being pushed forward on the Kandalaksha-Apatite-Khibin section of the Murmansk railway, and an expenditure for this year of 3,500,000 roubles has been assigned to the conversion of this 70-mile division.

Southport.—YEAR'S WORKING.—Mr. T. J. Kendrew, the borough engineer and manager of the municipal transport undertaking shows in his report for the year ended March 31st, 1934, that the tramway revenue fell from £38,813 to £33,427, and the working expenses from £30,632 to £28,591; the net capital charges were £780 as compared with £672 for the previous year. The decrease in revenue is due partly to the fact that the Roe Lane section was converted to motor bus running during May, 1932, although certain extensions have also taken place during 1933. The actual net profit on the tramway section of the undertaking was £5,615, as compared with £7,508 on the previous year. The total mileage run decreased by 47,444 to 672,159 owing to the substitution of petrol buses for trams on certain sections. The number of passengers carried also decreased by 931,159 to 6,631,889.

Salford.—ILLUMINATED TRAMCAR.—In connection with the recent visit of the King and Queen to open the new library at Manchester the Salford Corporation employed many forms

The Salford illuminated tramcar

of decorative lighting effects, one of the most striking being an illuminated tramcar, which was equipped throughout with Siemens lamps. For the jewels in the crowns seen in the photograph two hundred ruby lamps were used, and altogether two thousand lamps were installed on the car.

Wolverhampton.—ANNUAL REPORT.—Financial statistics for 1933-34 issued by the general manager (Mr. C. Owen Silvers) relating to the Transport Department show that, so far as the trolley-vehicles were concerned, the number of passengers carried increased from 29,127,599 to 34,215,694. Although there are fifty-one motor buses as compared with 105 trolley-vehicles, the buses carried only a little over five million people. Several conversions from motor to trolley-bus operation have taken place during the year. The revenue from the trolley-vehicles was £235,194 (£212,899 last year), working expenses being £151,372 (£134,149), and the net profit £15,581 (£8,815).

Communications

Burma.—BROADCASTING.—A message from Bombay states that a radio society for Burma has been organised with the object of fostering broadcasting, and one of its first duties will be to open a broadcasting station in Rangoon. Sir Oscar de Glanville, the President of the Burma Council, has been elected president of the Society.

China.—LONG-DISTANCE TELEPHONY.—The Ministry of Communications has decided to establish an Engineering Bureau to take charge of the projected nine-provinces long-distance telephone network. Mr. Wang Chihcheng, Director of the Engineering Bureau for the Chefoo-Tsinan Telephone Service, will be transferred as director of the new bureau.

Plans for the installation of long-distance telephone services to link Shanghai, Shaohsing, and Ningpo are being mapped out by the Ministry of Communications and the Chekiang Provincial Reconstruction Committee. The total outlay for the project is estimated at $100,000. As the Shanghai-Hangchow section is already in operation, it is expected that the entire service will be open by September.—*Chinese Economic Bulletin*.

Germany.—RADIO LICENCES.—The monthly figure of German radio listeners issued on August 1st again registered a decline. The figure was 5,357,819, a decrease of 1,661. Officially, the reduction is attributed to the holiday season.

RADIO-SET PRODUCTION.—According to statistics recently published by the German Radio Manufacturers' Association, 474,554 radio sets were sold between January 1st and June 30th this year. Of these, 240,659 were *Volksempfänger* (the standard cheap receiving set).

Great Britain.—RADIO RELAY SERVICE.—The Birchington-on-Sea Parochial Committee has received an application from the Broadcast Relay Service, Ltd., for permission to establish a relay service for the town, and the company is to submit its scheme. A similar application from Mr. C. Barrows, a local radio engineer, is also under consideration.

India.—BROADCASTING RESEARCH.—We learn from Madras that the Broadcasting Advisor to the Government has been conducting preliminary investigations into the local atmospheric and climatic conditions and their effect on transmission and reception. After finishing certain field work, he has now proceeded to Colombo, Bombay and the Punjab to study the broadcasting systems in those places, and, after concluding that work, will discuss matters with the Director of Wireless in New Delhi. A report of his activities will be published soon.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Argentina.—BUENOS AIRES.—October 1st. State Railways. Two electrically operated turntables. (G.Y. 14169.)*

Australia.—MELBOURNE.—Posts and Telegraphs Department. September 25th. Telephone transmitters and parts. (A.Y. 12544.)*

State Electricity Commission of Victoria. October 1st. Oil circuit-breaker equipment. (A.Y. 12571.)*

Victorian Railways. October 17th. Selector telephone equipment consisting of a control office with thirteen radiating lines. (A.Y. 12532.)*

TOWNSVILLE.—October 11th. One 1,000-kW self-contained turbo-alternator unit complete with exciter auxiliary plant and all necessary instruments and fittings. (A.Y. 12535.)*

Azores.—PONTA DELGADA.—November 5th. Municipal Council. Hydro-electric plant comprising Francis turbine, 3-phase alternator, oil-cooled transformer, switchgear, &c. (A.Y. 12504.)*

Barnes.—September 12th. Corporation. Traffic control signals. (August 10th.)

Belfast.—September 10th. Corporation. Lighting, heating, bells, telephones, &c., at Puredysburn Villa Colony. Specifications from N. Fitzsimons, Friends' Provident Building, Howard Street (deposit £3 3s.).

September 10th. Electric lighting installation, &c., at Massereene Hospital, Antrim. Particulars from F. D. Brown, 93, Anne Street (deposit £2 2s.).

Brighton.—September 10th. Corporation. One 30,000-kW turbo-alternator with condensing plant and auxiliaries, and one 150,000-lb. steam-raising unit. (August 10th.)

Bristol.—September 7th. Electricity Department. Four 130,000-lb. steam-raising units. (August 3rd.)

Chanctonbury.—September 7th. Rural District Council. Electric lighting installation at twenty-six houses at Sopers, Pulborough. Particulars from P. Ayling, clerk, Council Offices, Church Street, Storrington.

Cheddleton.—September 10th. Mental Hospital Committee. Six months' supply of stores, including electric lamps. Mr. E. Lawton, clerk to the Hospital.

Chesterfield.—September 3rd. Public Assistance Committee. Electric lighting installation at the Institution. County architect, Derby (deposit £2 2s.).

Croydon.—September 5th. Town Council. Six months' supplies of stores, including electrical fittings and appliances, for Queen's Road Homes and other institutions. Town Clerk, Public Assistance Offices, Mayday Road, Thornton Heath.

September 3rd. Public Health Department. Six months' supply of stores, including electrical fittings and appliances, for the Mayday Hospital, Croydon Borough Hospital, Croydon Borough Sanatorium, and Coombe Cliff Convalescent Home. Medical Officer of Health, Town Hall.

Dumfries.—September 7th. Town Council. Electric lighting at Stonehousecroft and Millbrae housing schemes. Form of tender from Borough Surveyor; tenders to Town Clerk.

East Africa.—MOZAMBIQUE.—October 15th. Port and Railway Administration. Gas producer, motor, alternator, and distribution board. (G.Y. 14075.)*

East Dereham.—September 3rd. Electricity Department. Cable, e.h.p. sub-station switchgear, transformers, kiosks and switchgear, and l.p. overhead distributor lines. (August 17th.)

East Sussex.—September 10th. Public Assistance Committee. Six months 'supply of stores, including electric lamps for eleven Poor Law Institutions. Particulars from Public Assistance Officer, West Street, Lewes.

Edinburgh.—September 5th. Corporation. Alterations to heating system and installation of additional plant at Craiglockhart Institution. Schedules from E. J. MacRae, city architect, City Chambers; tenders to Town Clerk.

Egypt.—CAIRO.—October 18th. Ministry of Public Works. Evacuating and dewatering pumps with electric motors, switchgear, main electric motors, accessories, switchgear and accessories, main and auxiliary transformers and accessories, oil for transformers and circuit-breakers, station electric lighting and equipment, and filter plant and accessories. (G.Y. 14151.)*

October 16th. Ministry of the Interior. Sub-station equipment, distribution and transmission lines for Tima. (A.Y. 12560.)*

GIZA.—December 6th. Ministry of Public Instruction. Apparatus for the electrical laboratory of the Royal School of Engineering. (A.Y. 12577.)*

Exeter.—September 6th. Devon County Council. Vehicle-actuated traffic signals at Torquay and Exmouth. Specifications from County Surveyor, 18, Cathedral Yard.

Farnworth.—September 15th. Electricity Department. T.r. and v.i.r. cables for year ending August 31st, 1935. (August 24th.)

Horwich.—September 10th. Electricity Department. Electrical materials. (August 24th.)

India.—SIMLA.—September 11th. Stores Department. Power station plant for Saidpore Power House. (A.Y. 12519.)*

DELHI.—Various dates. Stores Department. Ceiling and table fans (a.c. and d.c.) as required during the period April 1st, 1935, to March 31st, 1936. (A.Y. 12578-80.)*

Leeds.—September 15th. City Council. Boiler house equipment for Kirkstall power station extensions. Particulars from Mr. C. Nelson Hefford, 1, Whitehall Road, Leeds (deposit £5). (August 17th.)

Lincoln.—September 10th. Electricity Department. P.i. and r.i. cables, cookers, joint boxes and shells, consumers' fuse boxes, network boxes and meters. (August 24th.)

London.—FULHAM.—September 4th. Borough Council. Wiring and modernising the electrical installation in the old portion of the Town Hall. (August 10th.)

DEPTFORD.—September 19th. Borough Council. Vehicle-actuated traffic signals at Lewisham High Road and New Cross Road. Particulars from Borough Engineer, Town Hall.

WEST HAM.—September 10th. Single-phase a.c. prepayment meters, transformers, and v.i.r. and t.r.s. wires and cables for twelve months ending September 30th, 1935. (August 24th.)

KENSINGTON.—September 12th. Borough Council. Vehicle-actuated traffic control signals at five street junctions. Specifications from Borough Engineer and Surveyor, Town Hall, W.8.

New Zealand.—WELLINGTON.—Post and Telegraph Department. October 10th. Telephone cable (A.Y. 12554)* (A.Y. 12555.)*

October 17th. 5,000 four-conductor and 500 six-conductor telephone instrument cords. (A.Y. 12553.)*

Plympton St. Mary.—September 1st. Rural District Council. Supply and erection of h.v. switchgear, pole transformers, 6,300-V overhead lines, medium and low-voltage overhead and underground distribution mains, &c., in connection with the extension of Tamerton and Roborough. Details from the electrical engineer, Council Offices, Plympton.

St. Helens.—September 4th. Electricity Department. H. and l.p. p.i. cables. (August 17th.)

Salford.—September 5th. Electrical installations at divisional police headquarters, Pendleton. Particulars from City Electrical Engineer.

Sheffield.—September 18th. Electricity Department. Cooling towers and civil and constructional engineering work at Blackburn Meadows generating station, and civil and constructional engineering work at Neepsend power station. (August 3rd.)

Siam.—BANGKOK.—September 28th. Royal State Railways. 15,000 zinc electrodes for Meidinger batteries. (A.Y. 12574.)*

South Africa.—PORT ELIZABETH.—September 17th. South African Railways and Harbours. Pumping equipment for Port Elizabeth Harbour, (G.Y. 14113.)*

PRETORIA.—September 21st. Union Tender and Supplies Board. Four stationary batteries. (A.Y. 12566.)*

September 28th. Phonogram equipment. (A.Y. 12576.)*

JOHANNESBURG.—September 22nd. Municipality. Bare copper and weatherproof braided conductors. (A.Y. 12565.)*

September 20th. House service a.c. electricity meters. (A.Y. 12570.)*

Tasmania.—HOBART.—October 1st. Municipal Tramways. Electric motors and control and air-brake equipment for two tramcars. (G.Y. 14195.)*

Hydro-electric Commission. October 22nd. Four transformers for the Rosebery sub-station. (A.Y. 12584.)*

Trimdon (Co. DURHAM).—Parish Council. Extending the electric street lighting system at Trimdon Village. Particulars from J. G. Fenny, clerk to the council, Ropers Terrace.

Uruguay.—MONTEVIDEO.—September 28th. State Electricity Supply and Telephone Administration. H. and l.p. p.i. l.c. and s.a. cables and joint boxes. (A.Y. 12575.)*

Warrington.—September 18th. Electricity Department. Twelve months' supply of e.h.p. and l.p. paper-insulated and lead-covered (and other) cables, earthenware conduits, cable protector slabs and tiles. (See this issue.)

Wigtown.—September 10th. County Council. Various works, including electric tubing, at seventy-four houses. Specifications from R. G. Logan, county architect, Stranraer (deposit £1); tenders to County Clerk, County Buildings, Stranraer.

Willenhall.—September 3rd. U.D.C. Electric wiring of seventy-four houses at Bilston Lane. Plans, specifications, &c., from G. A. Waite, Town Hall (deposit £2 2s.); tenders to F. G. T. Webb, clerk, Town Hall.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Darvel.—Town Council. Accepted. Installation of electric lighting at houses (£128).—W. Ross.

Glasgow.—Corporation. Accepted. Electric lighting fittings for showrooms.—Lugg & Co., Ltd. (£294); Evered & Co., Ltd. (£165).

Sandown and Shanklin.—Urban Council. Accepted. Electric lighting fittings for the new concert pavilion on Sandown Pier (£163).—Falk, Stadelmann & Co., Ltd.

South Africa.—CAPE TOWN.—Electricity Committee. Accepted. Copper and galvanised iron wire.—Henleys (S.A.) Telegraph Works Co., Ltd. (£5,263); Johnson & Phillips (Pty.), Ltd. (£181); C. H. de Krielen & Co. (£124); C. F. Shaw, Ltd. (£101). Pole fuses (£1,067).—C. E. Scott (Pty.), Ltd. Hotel range and oven (£266).—S. A. General Electric Co., Ltd.

Tanfield (Co. DURHAM).—Urban Council. Accepted. North and South Wards electricity service extension:—Cable.—British Insulated Cables, Ltd. Kiosks.—Crompton Parkinson, Ltd.; General Electric Co., Ltd.

Notes

" Free Electricity "

Early this year the San Joaquin (California) Light and Power Corporation announced that it intended to permit its domestic and commercial lighting consumers to use as much electricity as they liked during May and June at the same charge per month as was made in March. Agricultural customers were to be charged half the ordinary rate for energy taken in excess of their March consumption. In the *Electrical World* Mr. A. E. Wishon, the president of the Corporation, summarises the results as follows:—

" First, a total of 43,224 domestic and commercial lighting customers, or 52.9 per cent. of those eligible, took advantage of the offer, using 5,633,911 free kilowatt-hours. This use was 40.5 per cent. of the kilowatt-hours paid for at the regular rates.

" Second, 10,726 agricultural power consumers, or 69 per cent. of the total, used 21,212,599 kW-hr in excess of their last year's consumption for the two special use months. This use, an increase of 102 per cent. over the kilowatt-hours paid for at the regular rate, was billed at half price, subject to refund of even this charge if the regular use for the agricultural year exceeds 4,000 kW-hr per horse-power.

" Third, personal calls on 18,000 domestic and commercial consumers to explain the plan found almost universal acceptance and appreciation.

" Fourth, merchants and dealers report sales of electrical merchandise in the territory as double to four times sales last year.

" Fifth, the total cost of the campaign, including increment power costs, special advertising and sales work, has been fully offset by increased sales. Our consumers were given more for their money and our net income was increased."

E.P.E.A. London Technical Group

The London Technical Group of the Electrical Power Engineers' Association will open its session on Saturday, September 8th, with a visit to the Eagle Iron Works, Oxford, of Messrs. W. Lucy & Co. The motor coach will leave Charing Cross at 8 a.m. Mr. J. Parr Morley, 25, Park Road, Bowes Park, N.11, is now hon. secretary for the group, in which he succeeds Mr. W. F. Andrews, who did such yeoman service for a number of years.

A Manual of Electric Pumping

A useful booklet with the above title has been compiled by the State Electricity Commission of Victoria in furtherance of its desire to assist consumers to obtain the most efficient utilisation of electricity in the factory and on the farm. After pointing out the advantages of electric power, the types of pump in general use are described before going on to the fundamental technical considerations involved. The general principles to be observed with belt drives are outlined next, followed by information and advice concerning motors and control gear. Some typical problems and their solutions are included, the booklet concluding with useful hydraulic data and an index. Copies of this publication can be obtained from the Electricity Supply Department, State Electricity Commission of Victoria, 238, Flinders Street, Melbourne, C.1, Victoria.

A Warning

We wish to put our readers on their guard against a man who may be fraudulently trespassing upon their generosity as he has recently done upon that of Venner Time Switches, Ltd. 'Phoning from King's Cross Station to the works of the company at New Malden, and saying that his father, a municipal official in the provinces, and Mr. E. E. Sharp (who was not at the office) were well-known to each other, he said that he had been robbed of his wallet and his return ticket home; would they telegraph him in the name of Sharp, and not that of the company, a money order for 22s. addressed to him at the station? His promise to return the money on the following Monday was of course not fulfilled, and inquiries disclosed that the aforesaid municipal official had no son, had never met Mr. Sharp personally, and knew nothing about the matter.

An Electrified Farm

Mr. R. B. Matthews writes asking us to state that the photographs used to illustrate the article entitled " An Electrified Farm " that appeared in our issue of August 3rd were of his electric farm at East Grinstead, Sussex. They were intended only to indicate the various applications of electricity to agriculture. The descriptions in the letterpress, which relate to a farm in the Midlands, would, of course, apply generally to similar apparatus on other farms.

An Electric Egg-candler

One of the latest minor applications of the photo-electric cell is to the process of candling eggs, sending them to be automatically graded and sorted at a minimum rate of thirty per minute, as against eighteen per minute by the ordinary method. The apparatus, which is being made by a firm at St. Louis, Missouri, U.S.A., provides for the continuous feeding of eggs by a travelling band on to two strips of soft rubber fixed to the sides of a box. Above the egg is a sheet-glass filtering the light from an electric lamp placed higher up and fitted with a reflector. Thus the light is made to pass through the egg during its slow transit. Below the egg is a self-generating photo-cell, connected to an ammeter calibrated to indicate good, medium and bad eggs, while directing them into their several paths. The apparatus, which is compact and of moderate size, is fitted with a small motor.

The Institute of Transport Examinations, 1935

The Institute of Transport announces that the next examinations for graduateship and associate membership will be held on April 25th, 26th and 27th, 1935. Principal transport undertakings will grant leave, without loss of pay, to employés who wish to sit for either of the examinations. Full particulars, previous question papers (price 1s. per set, post free), and copies of a booklet entitled " The Institute of Transport Examinations: Notes for the guidance of candidates unable to attend preparatory courses " (price 2s. 6d., post free) may be had on application to the Secretary of the Institute, 15, Savoy Street, W.C.2. The closing date for the receipt of applications to sit for the examinations is March 1st, 1935.

Exhibition of Inventions

The tenth International Exhibition of Inventions, organised by the Institute of Patentees, is to be held in the Central Hall, Westminster, S.W.1, from October 3rd to 13th.

Fatalities

While swimming at Portnant (Caernarvonshire) last week Robert Frazer Keill, aged 20, caught hold of a " live " stay wire on a landing stage and was killed. At the inquest, when a verdict of " accidental death " was recorded, it was explained that the stay was connected to a pole carrying an electric cable and had become electrified through a breakdown of the cable insulation.

The unexpected starting of an electrically operated cardboard box cutting and creasing machine at a Liverpool works recently caused the death of Robert Worthington Lanagan, who was cleaning the machine. Mr. J. E. Aitcheson, works electrical engineer, stated at the inquest last week that he found the handle of the switch in the " off " position, but inside the switchbox one side of a knife-blade was in contact. The claw action of the switch had failed to withdraw the blade on account of a small rivet falling. A cable leading to the motor was bare for $\frac{1}{16}$ in. on the underside and an earth wire several floors above had a hidden defect. Lanagan might have closed the circuit by accidentally displacing the bared wire near the motor while he was dusting. If any of the four circumstances had been absent the accident would not have occurred. A verdict of " accidental death " was recorded, the coroner remarking that there had been an extraordinary chain of circumstances.

The Properties of Tin

Technical publication No. 1, Series B, of the Tin Research and Development Council, has been compiled with the aim of rendering more readily available than hitherto, and in a more complete form, the quantitative data obtained from researches into the properties of tin. The figures, which are arranged in tabular form, have been selected from the original literature of the subject and refer to mechanical, thermal, optical, and such magnetic properties as volume, specific, and ionic susceptibility. Electrical data include resistivity down to minus 269.37 deg. C., at which tin becomes super conductive; temperature and pressure coefficients; change of resistance in a transverse magnetic field; Hall, thermo-electric, and pressure effects; heat of formation of ions, photo-electric threshold, electro-chemical equivalent, single electrode potential, and hydrogen overpotential.

Electric Boilers in Canada

Canadian central stations in May generated about 1,830 million kWh of electrical energy, of which 458.6 million kWh was delivered to electric boilers—about 25 per cent. of the total. This is estimated to be equivalent to a coal consumption of 88,500 tons; thus Canada, by the use of electric boilers, is saving coal at a rate of over one million tons annually. Canada's present generating capacity of approximately 7,000,000 h.p. permitted deliveries of energy to be made to consumers other than electric boilers at a load factor in May of about 37 per cent. The addition of the electric boiler load, however, increased this to 49 per cent., and a considerably higher figure can be obtained without increasing the existing installation. The first electric boilers were installed in Canada fourteen years ago by the Shawinigan Water and Power Co., at the Belgo-Canadian Pulp and Paper Mills, Shawinigan Falls, P.Q. Numerous installations have been added since, the total installation now reaching 1,250,000 kW, capable of consuming 900 million kWh per annum if used to their rated capacity.

Appointments Vacant

Power station engineer for the Port Directorate, Basrah, Iraq.

District electrical superintendent for the Bengal-Nagpur Railway Co., Ltd.

(See our classified advertisements.)

Makers' Names Wanted

" G.P." wire.

ACME electrical washer.

VACUETTE vacuum cleaner (British agents).

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. F. W. Clements, chairman of the Victoria Electricity Commission, has been reappointed by the State Government for another term of three years, at his present salary of £2,500 a year, less emergency reduction. Mr. Macfarlan, Minister in Charge of Electrical Undertakings, said that the Ministry was impressed by the capacity and suitability of Mr. Clements for the position, which was one of the most important and responsible in Victoria.

Mr. G. E. W. Knowles, B.Sc., son of Mr. W. C. Knowles, A.M.I.E.E., electrical and waterworks engineer of Elland, was married recently to Miss Jessie Ainley. The bridegroom is with the Yorkshire Electric Power Co., as assistant engineer, at Brigg, Lincolnshire.

Mr. J. S. McGill, a member of the staff of the Cape Town Municipal Electricity Department for nearly five years, was married at Carlisle, on August 18th, to Miss M. B. Hetherington.

Mr. John Richardson, Murthly, has been awarded the final grade diploma (first class) of the City and Guilds of London Institute in radio communication. He has been appointed to the radio staff of the General Electric Co., Ltd., at Coventry.

Mr. S. A. Swann, whose article on "Spare Plant Capacity" appears in this issue, is technical assistant in electrical machine design to the Brush Electrical Engineering Co., Ltd. He studied engineering at Nottingham University College, and in 1922 gained the degree of B.Sc. (Engineering) of London University. From 1922 until 1926 he was engaged as assistant lecturer in the Department of Electrical Engineering at Nottingham University College, and subsequently he held positions with the Nottingham Corporation Electricity Department and the Metropolitan-Vickers Electrical Co., Ltd. Mr. Swann is a graduate of the Institution of Electrical Engineers and an associate of the American Institute of Electrical Engineers.

The Committee on Noise.—The Minister of Tranpsort has announced the membership of the committee which has been appointed to consider and report upon the principal causes of noise in the operation of mechanically propelled vehicles and the steps which can be efficiently taken to limit the noise so arising. The chairman is Sir Henry Fowler, formerly chief mechanical engineer of the L.M.S. Railway, and the other members of the committee are Dr. H. J. Gough, M.B.E., superintendent of the Engineering Department of the National Physical Laboratory, Dr. G. W. C. Kaye, O.B.E., superintendent of the Physics Department of the N.P.L., Mr. E. S. Perrin, B.Sc., A.M.I.E.E., member of the Street Lighting and Traffic Safety Committee, Mr. H. R. Watling, director of the British Cycle and Motorcycle Manufacturers' and Traders' Union, Ltd., and Mr. L. Walton, deputy president of the Society of Motor Manufacturers and Traders. The secretary of the committee is Mr. A. E. N. Taylor, B.Sc.

Dr. G. W. C. Kaye

Mr. W. G. Watson, of Messrs. W. G. Watson & Co., Ltd., electrical engineers and merchants, Sydney, N.S.W., is on a visit to London in the interests of his company. His address is c/o Messrs. Sanderson, Murray & Elder, Ltd., 47, Gresham Street, E.C.2.

Mr. G. Bond, of the testing staff of the Yorkshire Electric Power Co., who was married on August 18th to Miss Mary Oates, of Mirfield, has been presented by his colleagues with a reading lamp.

The Stalybridge, Mossley, Dukinfield and Hyde Joint Tramways and Electricity Board has rejected a proposal by the Parliamentary Committee to pay **Mr. J. H. Lumsden,** the electrical engineer, £1,000 in commission and to increase his salary. The minute read: "The Committee considered an application from the electrical engineer, and resolved that he be paid £1,000 as commission in respect of the supervision entailed in the erection of the extensions to Hartshead power station; and that from April 1st, 1935, his salary be increased £50 per annum until it reaches the figure applicable to the undertaking set out in the scale approved by the Associated Municipal Electrical Engineers." Ald. Wood (Stalybridge) said that during the past four years Mr. Lumsden had advised, prepared and erected plant in the generating station without additional expert advice to the value of £150,000. Their previous engineer, for installing a smaller amount of plant, received £1,800.

Sir Holberry Mensforth, a director of several important electricity supply and power companies, who was accompanied by Lady Mensforth and their daughter, landed at Plymouth on August 19th after a cruise to Bermuda.

Mr. B. S. Hornby, who writes on "Uninsulated Neutrals" (page 271), is chief assistant to the electrical and tramways engineer of Bolton Corporation. He was educated at Dunstable Grammar School, and received training at a London mechanical engineering works, being later articled to Mr. J. G. W. Aldridge, A.M.Inst.C.E., consulting electrical engineer. Mr. Hornby entered the service of the Bradford Corporation Electricity Department in 1897, and was the first electrician-in-charge at the Valley Road works, from which a supply was given to the tramway system in 1898. He was appointed engineer-in-charge to Bolton Corporation in 1899, and took up his present position in the following year. Mr. Hornby is a member of the Institution of Electrical Engineers.

Mr. B. S. Hornby

Mr. J. S. Simmons, of Messrs. W. T. Henley's Telegraph Works Co., Ltd., is the subject of the latest "fish" story. We learn on good authority that he secured the prize for the first fish caught in the "lightning" competition at the recent Bognor Memorial Hospital Fishing Festival. We understand that Mr. Simmons's surprise at his success was only exceeded by that of the unfortunate fish.

Mr. W. C. Roy, who has resigned from the position of engineer and manager of Wick Electricity Department, has been presented with a gold wristlet watch by the employés of the Department. The presentation was made by Mr. Manson.

Obituary

Mr. S. E. Pridham, who was employed by the Exeter Radio Exchange and was well known in wireless trade circles in that city, died at the Royal Devon and Exeter Hospital on August 21st at the age of fifty-nine.

Mr. K. E. Archer.—The death took place on August 18th of Mr. Kenneth Edward Archer, electrical engineer, Wycke Hill, Maldon, Essex. He was thirty years of age, and was apprenticed with Girlings, Ltd., Station Road, Maldon. He became manager of the firm's showrooms at Saffron Walden, and left to establish his own business at Cambridge, later moving to Hull.

Mr. F. O. Harrison.—The death occurred on August 22nd in his sixty-second year of Mr. F. O. Harrison, A.M.I.E.E., works manager of the Tudor Accumulator Co., Ltd. Mr. Harrison was educated at the United Westminster School and received his technical training at Finsbury Technical College. In 1892 he was appointed engineer to the Galway Electric Supply Co. and later he became designing draughtsman to Messrs. Allen Baker & Co. He joined the Tudor Accumulator Co., Ltd., in March, 1898, as inspecting engineer; he was appointed assistant works manager in 1906 and works manager in January, 1932.

The late Mr. F. O. Harrison

The Hon. Evelyn Hubbard, who died last week at the age of eighty-two, was for many years connected with a number of electrical companies. He was a director of the Oriental Telephone & Electric Co., Ltd., the China & Japan Telephone & Electric Co., Ltd., and the Metropolitan Railway Co.

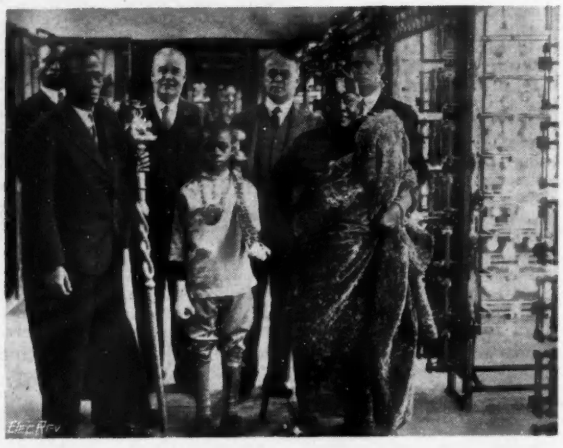
Wills.—**Dr. J. C. Stitt,** a former director of the British Insulated Company, left £63,261 gross, and £62,432 net personalty.

Mr. J. Dunnachie, late chairman and director of the Glenboig Union Fireclay Co., Ltd., left £9,674 personal estate in Great Britain.

Electricity Supply in Portugal

A REPORT which has recently been issued on electricity supply progress in Portugal by Mr. Ferreira Dias, chief engineer to the Portuguese Government Department of Hydraulic and Electrical Services, shows that at the end of 1933 there were 569 generating stations in the country with a total installed capacity of 206,998 kW, as compared with 595 and 209,865 kW respectively at the end of the previous year. Eighty-six of the stations, representing 53,614 kW, were hydro-electric, while 483 (153,384 kW) were operated either by steam or internal-combustion engines.

It is explained that the reduction in the number of stations was due to the shutting down of thirty-one small private plants, and the starting of five new public undertakings. Of the total, 170 stations, totalling 158,822 kW, were engaged in the supply of power to the public and for traction purposes, while 399 stations (48,176 kW) were owned by private undertakings. The majority of the public utility plants are of a small character, the average capacity being about 834 kW; only seven stations have a capacity of over 5,000 kW. In the case of the privately-owned plants, the average capacity is even smaller, being only about 120 kW, and the average of the six largest 1,727 kW.



Sir Ofori Atta, K.B.E., an African potentate, with his suite, photographed in the Life Test Department of the G.E.C. Research Laboratories, Wembley. Mr. C. Wilson, director of the Osram Lamp Works, is seen third from the left

The total output of electric power in the country during 1933 is given as 302,046,989 kWh, as compared with only 286,705,954 kWh in the previous twelve months, an increase of 5.4 per cent. Hydro-electric plants were responsible for 97,541,416 kWh, and steam and internal-combustion engined stations for 204,505,573 kWh. Mr. Dias draws special attention to the possibilities of further developments in water power utilisation, pointing out that whilst in Portugal the proportion of hydro-electric power to the total output declined from 36 per cent. in 1932 to 32 per cent. last year, in Italy 93 per cent. of the production is furnished by hydro-electric installations.

The public utility stations produced 249,799,993 kWh and the privately-owned plants 52,246,996 kWh. The three principal undertakings are the Companhia Reunida Gas e Electricidade, of Lisbon, with an output of 76,536,185 kWh; the Electrica dal Lima e Unias Electrica Portuguesa, with 65,416,763 kWh; and the Hidro Electrica do Varosa with 18,050,346 kWh.

The total number of electricity consumers in the country increased during the year from 222,555 to 233,025. Of these the largest number (94,659, a decrease, however, from 96,445) are in the Lisbon district, with an aggregate consumption of 100,336,616 kWh, and the Oporto area with 50,051 consumers, responsible for 74,575,500 kWh. Of the total consumption 20.3 per cent. was utilised for traction purposes, 2.9 per cent. by the electro-chemical industries, 51.8 per cent. for various power purposes, and the remainder (25 per cent.) for public and private lighting.

The Consumption per Head

A further table shows that of the population of the country of 6,190,199, electricity supply is now available to 5,465,891. The annual consumption per person to whom public supply is available ranged from only 2.1 kWh in the province of Braganca to 113.7 kWh in the Lisbon area and 93.8 kWh in the Oporto area; the average for the whole country is only 39.1 kWh per year, or 48.9 kWh when the output of the privately owned plants is taken into consideration. As regards individual cities, Oporto is the most important electricity user, the average annual consumption per inhabitant for all purposes, including public lighting and traction, being now 187.2 kWh per year as against 146.6 kWh for Lisbon.

As regards distribution, there are now about 2,012 miles of h.p. lines in Portugal, an increase from 1,794 at the end of 1932, about 1,750 miles are overhead and the remainder underground. Of the overhead lines, 1,296 miles operate at pressures up to 25,000 V, 275 miles between 25,000 and 50,000 V and 177 miles at over 50,000 V. The bulk of the overhead lines (1,183 miles) are supported on steel masts, only 122 miles being on ferro-concrete masts, 322 miles on wooden poles, and 122 miles employing iron and wooden poles.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Electrical Safeguards, Ltd.—Private company. Registered August 23rd. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of electrical and other gloves, mats, &c. The subscribers are: E. Mitchell, 39, Raymond Road, Upton Park, E.13, and Miss D. E. Oram, 77, Grenoble Gardens, Palmers Green, N.13. So long as J. W. Newton & Co. (London), Ltd., hold shares in the company they may nominate one director. Registered office: 56, Southwark Street, S.E.1.

H. Knowles & Co., Ltd.—Private company. Registered August 23rd. Capital, £5,000 in £1 shares. Objects: To carry on business as electrical and mechanical engineers, &c. The permanent directors are: H. Knowles, 2, Woodlands Road, Bexley Heath, Kent, and R. E. Love, 6, Warrior Square Terrace, St. Leonards-on-Sea. Registered office: 20, Cursitor Street, E.C.

Gaplamp, Ltd.—Private company. Registered August 21st. Capital, £3,000 in 2,000 6 per cent. preference shares of £1 each and 20,000 ordinary of 1s. each. Objects: To carry on the business of manufacturers of and dealers in electric, gas and oil lamps, neon and cathode-ray tubes, quartz lamps, reflectors, bells, fires, stoves, cookers, switchboards, &c. Directors: Fredk. R. Lankshear, 1, Freemans Court, E.C.2, and two others. Solicitors: Wingfields, Halser & Trustram, 61, Cheapside, E.C.

A. D. Rack Distributors, Ltd.—Private company. Registered August 22nd. Capital, £100 in 1s. shares. Objects: To carry on the business of electrical and general engineers, agents for and dealers in electrical goods and ironmongery of all kinds, &c. The first directors are: E. C. G. Hefti, 22, Stanford Way, S.W.16, and E. M. F. Cogni, 51, Grange Park, Ealing, W.5. Registered office: 5, John Street, Bedford Row, W.C.1.

Radio Contracts, Ltd.—Private company. Registered August 15th. Capital, £10,000 in £1 shares. Objects: To adopt an agreement with H. O'Connell and R. L. Armitage, and to carry on the business of radio engineers, hirers out of wireless receivers, &c. The subscribers are: L. J. Signy, 61, Carey Street, W.C.2, solicitor, and W. G. B. Roomes, 67, Kellett Road, Brixton, S.W.2, solicitor's managing clerk. Ronald Lister Armitage is a permanent director. Secretary: R. L. Armitage. Registered office: 61, Carey Street, W.C.2.

Radio & Electrical Equipment Renters, Ltd.—Private company. Registered August 24th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio sets, refrigerators, gramophones, &c. The subscribers are: W. Lewis, 100, Sandringham Road, Watford, and H. Bullock, 45, Carlisle Avenue, W.3. Solicitors: Harris, Chetham & Cohen, 6, Stratford Place, W.1.

E.M.F. (Electrical), Ltd.—Private company. Registered August 25th. Capital, £5,000 in £1 shares. Objects: To carry on the business of factors and merchants of and dealers in electrical apparatus and accessories, &c. The first directors are: D. S. Cleaver, 44, East Park Parade, Northampton, and two others. Solicitors: Owen & Co., 23, Friar Lane, Leicester.

Haslemere Radio & Electrical Co., Ltd.—Private company. Registered August 24th. Capital, £2,500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless apparatus, scientific instruments, mechanical and electrical engineers, &c. The first directors are: F. J. Privett, "Alresford," Craneswater Park, Southsea, and four others. Secretary: Vera C. Garner. Registered office: West Street, Haslemere, Surrey.

British Loewe Manufacturers, Ltd.—Private company. Registered August 24th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio devices, instruments and apparatus of all kinds, &c. The subscribers are: D. L. Loewe, 21, Meadway, Southgate, and J. F. H. Templer, 4, Sandringham Road, Birkdale. Registered office: 3 & 4, Clement's Inn, Strand, W.C.2.

Returns of Electrical Companies

North Wales Power Co., Ltd.—Particulars have been filed of three per cent. guaranteed debenture stock, to secure £1,468,100, authorised July 28th, 1934, and covered by trust deed dated August 17th, 1934, the whole amount being now issued. Property charged: Land within the meaning of the Law of Property Act, 1925, belonging to the company, rights of the company under the North Wales Electric Power Act, 1904, and the North Wales and South Cheshire District Order, 1923, and the deed of transfer dated December 5th, 1923, executed pursuant thereto; all sums which may become payable on any purchase by any local authority or other body of the company's undertakings and properties under any Act or Order, lands and hereditaments hereafter acquired, generating stations, &c., and the company's undertaking and other assets, present and future. Trustees: Whitehall Trust, Ltd., 11, Old Broad Street, E.C.

A. W. H. Sound Reproducing Co., Ltd.—H. E. Colesworthy, Alderman's House, Bishopsgate, E.C.2, was appointed receiver and manager on August 15th, 1934, under powers contained in instrument dated May 5th, 1933.

Maestro Products, Ltd.—G. B. Gaunt, Clock Chambers, London Road, Enfield, was appointed receiver on August 10th, 1934, under powers contained in debenture dated July 28th, 1933.

Denman's Electricity, Ltd.—The nominal capital has been increased by the addition of £500 beyond the registered capital of £1,000. The additional capital is divided into 500 10 per cent. cumulative preference shares of £1 each.

H. Clarke & Co. (Manchester), Ltd.—First debenture charged on the company's assets, including uncalled capital dated August 3rd, 1934, to secure all moneys due or to become due from the company to Martins Bank, Ltd.

British Goldring Products, Ltd.—Mortgage on land with factory and building thereon at South Woodford, dated August 15th, 1934, to secure £2,500. Holder: G. D. Smith, Balfour House, Finsbury Pavement, E.C.

Ipswich Wireless Co., Ltd.—Further charge, dated August 7th, 1934 (and supplemental to mortgage dated December 21st, 1931), to secure £350. Property charged: 46 and 48, Westgate Street, Ipswich. Holders: Mrs. E. Fenn, G. Fenn, T. S. Fenn, and E. O. Hines, all of Ipswich.

Crannage Radio, Ltd.—Debenture, dated August 10th, 1934, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: F. Eade, Yew Tree Cottage, Blackboys, Framfield, Sussex.

Portable Electric Power Co., Ltd.—Mortgage on certain patents dated August 3rd, 1934, to secure sums referred to in two agreements dated December 19th, 1933, and August 3rd, 1934. Holders: Mall Industrial Trust, Ltd., 50, Pall Mall, S.W.

Abro Radio & Motor Co., Ltd.—Mortgage debenture dated August 1st, 1934, to secure £600, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Mrs. A. Abrams, 60, Heywood Street, Cheetham, Manchester.

Radio Instruments, Ltd.—Debenture dated August 10th, 1934, to secure £12,000, charged on the company's undertaking and assets, including "Radio Works," Purley Way, Croydon, and uncalled capital. Holders: Credit for Industry, Ltd., Regis House, King William Street, E.C.

Electric Ignition Laboratory, Ltd.—Capital, £2,000 in £1 shares. Return dated May 28th, 1934. 1,500 shares taken up. £1,500 considered as paid. Mortgages and charges: None registered.

Cornwall Power Co., Ltd.—Capital, £400,000 in 150,000 preference and 250,000 ordinary shares of £1. Return dated May 18th, 1934. All shares taken up. £190,007 paid on 150,000 preference and 40,007 ordinary shares, £209,993 considered as paid on 209,993 ordinary shares. Mortgages and charges, nil.

Clowne Electric Supply Co., Ltd.—Capital, £3,000 in £1 shares. Return dated May 30th, 1934. 3,000 shares taken up. £3,000 paid. Mortgages and charges, nil.

Willmott, Son & Phillips, Ltd.—Capital, £1,000 in £1 shares. Return dated May 31st, 1934. 501 shares taken up. £501 paid. Mortgages and charges, nil.

Bath Electric Tramways, Ltd.—Capital, £230,000 in 75,000 preference, 125,000 preferred ordinary, and 30,000 deferred ordinary shares, all of £1. Return dated April 10th, 1934. 75,000 preference, 75,606 preferred ordinary, and 30,000 deferred ordinary shares taken up. £150,606 paid, £30,000 considered as paid. Mortgages and charges: £103,803.

British Radio Manufacturing Co. (Liverpool), Ltd.—Mortgage debenture, dated August 16th, 1934, to secure £160, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: C. G. Williams, 9, South Castle Street, Liverpool.

Nox Electric Lamp Co., Ltd.—The nominal capital has been increased by the addition of £10,000 beyond the registered capital of £15,000. The additional capital is divided into 10,000 redeemable 6 per cent. cumulative preference shares of £1 each.

Parmiter, Hope & Sugden, Ltd.—The nominal capital has been increased by the addition of £10,000 in £1 shares beyond the registered capital of £15,000.(4,981 of the new shares are to be issued as 5 per cent. cumulative preference, ranking *pari passu* with existing shares, and the remainder may be issued as the directors determine.)

A. Rist (1927), Ltd.—Capital, £60,000 in 80,000 8 per cent. preferred ordinary shares of 10s. and 400,000 deferred shares of 1s. Return dated May 31st, 1934. 70,000 preferred ordinary and 400,000 deferred shares taken up. £55,000 paid. Mortgages and charges, £6,000.

Cawnpore Electric Supply Corporation, Ltd.—Capital, £547,986 in 200,000 preference and 347,986 ordinary shares of £1. Return dated May 29th, 1934. 200,000 preference and 200,000 ordinary shares taken up. £325,000 paid on 200,000 preference and 125,000 ordinary shares. £75,000 considered as paid on 75,000 ordinary shares. Mortgages and charges, £195,360.

L. E. Wilson & Co., Ltd.—Capital, £2,000 in £1 shares. Return dated May 23rd, 1934. 1,601 shares taken up. £1,601 paid. Mortgages and charges, nil.

Barlborough Electric Supply Co., Ltd.—Capital, £3,000 in £1 shares. Return dated May 28th, 1934. 2,680 shares taken up. £2,680 paid. Mortgages and charges, nil.

Alert Electrical Co., Ltd.—Capital, £2,000 in £1 shares. Return dated May 1st, 1934. 711 shares taken up. £711 paid. Mortgages and charges, nil.

Aidas Electric, Ltd.—Capital, £1,000 in £1 shares. Return dated May 25th, 1934. All shares taken up. £1,000 paid. Mortgages and charges, nil.

Electro-Rentals, Ltd.—Capital, £15,000 in £1 shares. Return dated May 21st, 1934. 13,100 shares taken up. £13,100 paid. Mortgages and charges, nil.

City Notes

The Tokyo Electric Light Co. reports that at the end of May it served 11,108,940 electric lamps and had a connected power load of 962,000 kW, an increase of 152,790 lamps and 36,562 kW since the end of the preceding half-year. The maximum output during the six months to the end of May was 842,214 kW. This was 5,909 kW less than in the corresponding period of last year, the reason being a curtailment of the secondary power supply on account of the drought. The primary power supply was higher than last year. A sum of 1,812,180 yen was appropriated to amortisation of debt discount, and a surplus similar to that from the last half-year was carried forward.

J. & F. Stone Lighting & Radio, Ltd., in their first report, covering the six months ended June 30th, record a net profit of £8,004. Income tax reserve receives £1,000, and £1,700 is written off from underwriting commission, &c. It is proposed to pay a dividend of 2d. per share, less tax, equal to 10 per cent. per annum for the four months' trading to June 30th, and to carry forward £137. Since the formation of the company a further eleven shops have been taken, and all of these will be opened before the end of September.

The Consolidated Gas, Electric Light & Power Co. of Baltimore has announced a dividend of $0.9 (same) on the common shares for the quarter ending September 20th, payable on October 1st.

Pinchin, Johnson & Co. have declared an interim ordinary dividend of 7½ per cent., less tax (against 6 per cent.).

The Pennsylvania Water & Power Co. has announced a dividend of 75 cents on the common shares for the quarter ending September 30th.

John Ismay & Sons, Ltd., are to hold an extraordinary meeting on September 5th to consider a resolution to increase the capital to £300,000. It is proposed to create 100,000 6½ per cent. cumulative preference shares of £1 each and 1,000,000 ordinary shares of 1s. each. It is not proposed to issue the whole of the new shares at present.

The Canadian General Electric Co. has announced a dividend of 75 cents (same) per share on the common stock for the three months ending September 30th.

Stocks and Shares

TUESDAY EVENING.

THE holiday season is marching to its conclusion, and Stock Exchange members congratulate themselves that, on the whole, August has been a less uninteresting and unprofitable month than it is as a rule. Weekly comments here have borne testimony to the greater volume of business that is passing at the present time, as compared with what the Stock Exchange usually expects. It must be admitted, however, that barren patches intervene, and one of these the current week has presented to most markets round the House. Prices are firm, but there is little outstanding feature.

Home Railway Stocks

Dealers in the Home Railway market have asked for suggestions as to what stocks their brokers shall put before clients who wish to place money into gilt-edged securities, confess with a shrug of their shoulders that they have very little to offer. This applies not only to the stocks of the main-line companies, but also to those of the Tube combination. London Passenger Transport fixed interest stocks show improvement on balance. No change has occurred in the "C," which remains at 80, but the 5 per cent. "B" issue is 1¼ higher at 124. It may be of interest to mention that Metropolitan consolidated guaranteed stock is quoted at 78. The stock has received no dividend for over a year. Many inquiries are coming in as to the probable date when the 3½ per cent. dividend is going to be distributed. Nothing definite is known, but as the dividend on the Transport "C" will be sent out on September 10th, it is assumed in the market that the cheques in respect of the Metropolitan guaranteed 3½ per cent. stock will follow very shortly afterwards. In fact, September 21st is estimated as being the approximate date upon which holders of the stock may expect to get their dividends. Annoyance is expressed in connection with the delay in making this payment, because holders of Metropolitan guaranteed argue that the distribution of their interest should depend, logically, in no way upon the dividend on Transport "C" stock.

American Income Tax

No little pother has arisen as a consequence of a demand by the Federal Government at Washington for a return of profits made by "non-resident aliens" in American stocks

and shares when these operators have been dealing in the United States. Most people are aware that Americans are liable in their own country for tax upon profits which they make by speculating. Under U.S. law, realised profit is treated as income, and as liable to tax. Against the profits they make, the United States operators are allowed to set losses, but they pay income tax on the former if profits have been made during the accounting period. The present endeavour of the Federal Government is to obtain payment of this income tax from foreigners who have been dealing in the United States exchanges, from 1929 to 1933 inclusive, either in commodities or in securities. Although the claim may be valid, it is extremely difficult to say whether demand for income tax can be enforced upon the "non-resident alien" possessing no property in the United States. Consequently, the Federal Government's demand has been received with more interest than apprehension. If there should be British readers who have dealt as private individuals in the United States and made profits, they can disregard the claims from Washington provided they have no assets on the other side of the Atlantic. The Stock Exchange, the banks and other financial institutions are obliged to treat the matter with greater seriousness.

Cables and Wireless Stocks

The index number announced by Cables & Wireless for July, and quoted in last week's issue, has brought in a little support for the stocks, in spite of the fact that the 68.9 for July goes against 70.1 in June. The two ordinary stocks are both ¼ higher, and the preference at 71½ shows a gain of 1½ points. American Telephone & Telegraph strengthened to 112¼. International Telephones are a little better at 10¼. The tap of selling in the case of Great Northern Telegraphs has been turned off, and the price has recovered £1 to £36. Anglo-Portuguese Telephone are quoted at 28s. There has been a little inquiry for Telephone & General 7 per cent. preference, and on this the price firmed up to 29s. 9d. Western Unions remain at 37¼.

Electricity Supply Shares

St. James' & Pall Mall ordinary at 36s. have put on a shilling, bringing the yield into close correspondence with that afforded by other companies in the London group whose dividends are at the standard rate of 7 per cent. as compared with the 7½ per cent. paid by the St. James' undertaking. Electric Supply Corporation at 60s. 9d. are ninepence better. Some of the provincial shares are ex dividend, Bournemouth & Poole, for instance, at 77s. 6d., and Clyde Valley at 38s. 9d. Richmonds are also ex dividend this week, and are quoted at 55s. In the foreign list, Tokyo 6 per cents. at 80¾ are up 2¾, upon publication of figures that are regarded as being satisfactory. Atlas Electrics are a shade better at 6s. 4½d. British Power & Light remain a few pence under £1 per share. Ten thousand Electric Supply Corporation 6 per cent. cumulative preference shares have come on offer at 30s. 2½d. The next dividend is due in January, 1935. At 30s. the yield would be around 4 per cent. on the money. The annual dividend service requires £15,000, and last year's accounts showed £64,000 to be available. The Electric Supply Corporation holds 66,000 Hendon Electric ordinary, together with a large part of the issued share capital in five electricity supply companies in Sussex. It also supplies electricity in Dumbarton, Falmouth, St. Andrews and Totnes. West Gloucestershire ordinary stock is firmer at 87½.

Radio and Equipment Companies

According to newspaper accounts, the Radio Exhibition proved to be a success from the point of view of exhibitors and of the trade generally. The exhibition has now left Olympia, and has gone North, so that the results to be obtained from this publicity are likely to make themselves felt for some little time to come. The market in radio shares is receiving increased attention; Pye Radio, E. K. Cole, and McMichaels are attracting public interest. Electrical & Musical Industries ordinary strengthened to 28s. 3d. Shares in the electrical manufacturing and equipment group are holding their prices, without showing many noteworthy changes. Arons at 56s. 3d. have again advanced. British Insulated are better, gaining 1/16 at 71s. 3d. Johnson & Phillips rose to 23s. 3d. Associated Electrical Industries are also firmer. No movement of consequence has occurred in the shares of Callender's, Enfield, Henley's or the G.E.C.. The amount of floating supply of stock in the market in each of these cases is negligible. It would require very little buying to bring about a material advance in quotations, in spite of the extremely modest character of the yield to be obtained from investment in the shares at present prices, and on the basis of the last paid dividends.

Miscellaneous Matters

British Electric Traction deferred at 700 is up no less than 45 points. The preferred ordinary holds its last week's modest gain of 3. The foreign transport issues are irregular. Mexican Light & Power fives have lost 2, reacting to 45½. Philips Incandescent Lamps are a good market, showing a rise to 43s. 6d. Rubber shares are in quiet request, the price-list marking improvements on every business day. Iron and steel investments show little alteration. Victoria Falls ordinary are—for once in a way—1/16 down, at 6 7/16, a negligible decline in view of the shares' previous substantial advance.

Share List of Electrical Companies

Home Electricity Companies.

	Nom.	Dividend. 1932.	Dividend. 1933.	Price. Aug. 28.	Rise or Fall.	Yield. p.c. £ s. d.
Bournemouth and Poole	1	15	15	77/6xd	—	3 17 2
Brompton Ordinary	1	7	7	34/-	—	4 2 4
Charing Cross Ordinary	1	7	7	34/6	—	4 1 2
Chelsea	1	7	7	34/-xd	+6d.	4 2 4
City of London	1	7½	7½	36/3xd	+6d.	4 2 9
Clyde Valley	1	7	7	38/9xd	—	3 12 2
County of London ... * ...	1	10½	10½	57/6	—	3 13 1
Edmundson's 7% Pref.	1	7	7	34/6	—	4 1 2
Elec. Dis. Yorkshire	1	9	9	47/6	—	3 15 9
Elec. Supply Corporation ...	1	11	11	60/9	+6d.	3 12 4
Kensington Ordinary	1	7	7	34/-	—	4 2 4
Lancs Light and Power	1	7	7½	37/6	—	4 0 0
London Electric	1	7	7	34/-	—	4 2 4
Metropolitan	1	10	10	53/9	—	3 14 6
Midland Counties	1	7	7	37/6	—	3 14 8
Mid. Elec. Power	1	8	8	43/9	—	3 13 2
North Eastern Electric Ordinary	1	6	6	33/-	—	3 12 10
Do. 7% Pref.	1	7	7	35/-	—	4 0 0
Northampton	1	10	10	53/-	—	3 15 4
Notting Hill 6% Pref.	10	6	6	14½	—	4 4 4
North Met. Elec. Ordinary ...	1	10	10	3 3/8	—	3 5 3
Do. do. 6% Pref.	1	6	6	31/-	—	3 17 5
St. James' and Pall Mall ...	1	7	7½	36/-	+1	4 3 4
Scottish Power	1	8	8	40/-	—	4 0 0
South London	1	7	7	36/-	—	3 17 9
Westminster Ordinary	1	7	7	34/0xd	—	4 2 4
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	21/-	—	7 2 10
Yorkshire Elec.	1	8	8	46/3	—	3 9 1

Public Boards.

Central Electricity, 1950–70 ...	Stock	5	5	115	—	4 7 0
Do. 1955–75 ...	,,	5	5	118	—	4 4 0
Do. 1951–73 ...	,,	4½	4½	109	—	4 2 7
Do. 1963–93 ...	,,	—	3½	101	—	3 9 4
London & Home Counties, 1955–75	,,	4½	4½	108	—	4 3 4
London Passenger Transport, A...	,,	—	4½	120	—	3 15 0
Do. do. B...	,,	—	5	124	+1½	4 0 8
Do. do. C...	,,	—	3	80	—	3 15 0
West Midlands Joint Elec. 1948–68	,,	—	5	114	—	4 7 0

Telegraph and Telephones.

American Tel. & Tel.	$100	9	9	112½	+3	8 0 1
Anglo-Am. Tel. Pref.	Stock	6	6	112	—	5 7 1
Do. Def.	,,	1½	1½	27	—	5 11 1
Cables & Wireless 5½% Pref. ...	,,	2¾	2¾	71½	+1	3 17 0
Do. A. 7½% Ord.	,,	Nil	Nil	4½	+½	—
Do. B. Ord.	,,	Nil	Nil	7	+½	—
Globe Tel. and T. Ord.	10	Nil	2½	8¼	—	2 17 6
Do. do. Pref.	10	6	6	12½	—	4 16 0
Great Northern Tel.	10	20	20	36	+1	5 11 1
Marconi-Marine	1	10	7½	31/3	—	4 16 0
Oriental Telephone Ord.	1	12	12	3 1/8	—	*3 15 3

Home and Foreign Trams, Etc.

Anglo-Arg. Trams First Pref. ...	5	Nil	Nil	1/6	—	—
Do. do. 2nd Pref. ...	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5½	—	—
British Electric Traction Df. Ord.	,,	5	5	700	+45	—
Do. do. Pref. Ord.	,,	8	8	160½	—	4 19 8
Brazil Traction	100	—	—	11½	—	—
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	105	—	4 15 3
Mexico Trams, 5% Bonds ...	—	5	5	22½	—	—
Mexican Light Common	100	Nil	Nil	2½	—	—
Do. 7% Pref.	100	7	7	4½	—	—
Do. 1st Bonds	—	5	5	45½	−2	11 0 0
Victoria Falls Ord.	1	15	20	6 7/16	−1/16	3 2 0
Yorkshire (West Riding) ...	1	2½	5	25/9	—	3 17 8

Manufacturing Companies.

Aron Electricity Ord.	1	10	10	56/3	+ 1/16	3 11 0
Assoc. Elec. Ord.	1	4	3	19/-	+6d.	3 3 2
Do. Prf.	1	8	8	32/-	—	5 0 0
Babcock & Wilcox	1	9	6	44/-	—	2 14 7
British Aluminium Ord.	1	5	5	28/3	—	3 11 0
British Insulated Ord.	1	15	15	71/3	+ 1/16	4 4 3
Brush Ord.	Stock	Nil	Nil	33	—	—
Callender's	1	15	15	3 1/8	—	4 14 1
Do. 6½% Pref.	1	6½	6½	31/3	—	4 3 2
Crompton Parkinson Ord. ...	5/-	22½	12½	25/6	—	4 18 4
Do. 8% Pref.	1	8	8	33/9	—	4 14 10
Edison-Swan 1st Pref.	1	7½	7½	21/3	—	7 1 2
Do. 5% Deb.	Stock	5	5	107½	—	4 13 0
Electric Construction	1	Nil	Nil	10/-	—	—
Enfield Cable Ord.	1	25	20	85/-	—	4 14 1
English Electric	1	Nil	Nil	5/9	—	—
Do. do. Pref. ...	1	Nil	Nil	9/6	—	—
Ever Ready	5/-	35	35	28/6	—	6 2 8
Ferranti Pref.	1	7	7	26/6	—	5 5 8
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	8	8	45/9	—	3 9 11
Henley's	1	30	30	6½	—	4 17 8
Do. 4½% Pref.	5	4½	4½	5½	—	4 1 9
India-Rubber Preferred	1	—	—	18/9	—	—
Johnson & Phillips	1	5	5	23/3	+ 1/16	4 6 0
Siemens Ord.	1	6½	4	17/6	—	4 11 5
Telegraph Construction	£1	Nil	Nil	1	—	—

*Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1932

30151. "Electrical insulators." Steatite & Porcelain Products, Ltd., and G. H. Halton. October 27th, 1932. (414387.)

30513. "Electric starting devices for internal-combustion engines." Eclipse Machine Co. October 31st, 1931. (414351.)

30574. "Electrical musical instrument." L. Mellersh-Jackson and O. Vierling. October 31st, 1932. (414352.)

31586. "Miners' and like safety lamps." E. A. Hailwood. November 9th, 1932. (Cognate application 33573/32.) (414420.)

1933

2862. "Electric clocks." F. Loeffler. January 30th, 1933. (Convention date not granted.) (414372.)

2879. "Electric motor and like controllers." A. West & Co., Ltd., and W. Taylor. January 30th, 1933. (414373.)

2891. "Tuning and indicating devices for radio receivers and like high-frequency apparatus." British Thomson-Houston Co., Ltd. January 30th, 1932. (414354.)

2892. "Indicators for the tuning mechanism of radio apparatus." British Thomson-Houston Co., Ltd. January 30th, 1932. (414402.)

2896. "Electrolytic condensers." Telegraph Condenser Co., Ltd., and W. J. Cole. January 30th, 1933. (414374.)

2987. "Thermionic valves." S. P. de Laszlo. January 31st, 1933. (Cognate application 35000/33.) (414357.)

3025. "Means of correcting distortion of electric signals by amplifiers." General Electric Co., Ltd., L. I. Farren and G. C. Marris. January 31st, 1933. (414359.)

3060. "Indirectly heated cathode." Dr. S. Loewe. February 2nd, 1932. (414375.)

3125. "Electric discharge lamps." British Thomson-Houston Co., Ltd., and General Electric Co., Ltd. February 1st, 1932. (414391.)

3141. "Wireless and like signalling apparatus." J. Robinson and British Radio-stat Corporation, Ltd. February 1st, 1933. (414382.)

3981. "Telephone system signalling arrangements." Standard Telephones & Cables, Ltd. June 21st, 1932. (414423.)

4485. "Machine for the measuring and marking of electric cables and similar articles." Callender's Cable & Construction Co., Ltd., and J. R. Wilkinson. February 14th, 1933. (414437.)

4577. "Attachment for supporting a small electric lamp on one or more fingers, the thumb or wrist of the user's hand." M. H. Richardson. February 15th, 1933. (414438.)

4837. "Wireless receiving apparatus." A. T. Richter. February 16th, 1933. (414441.)

5234. "Regulating means for electrical power systems." Westinghouse Electric & Manufacturing Co. March 2nd, 1932. (414444.)

6641. "Electric lamp and like fittings." J. Etchells and Associated Electrical Industries, Ltd. March 4th, 1933. (414449.)

7869. "Liquid-break electric switches." International General Electric Co., Inc. March 16th, 1932. (414455.)

8141. "Electric discharge apparatus." W. Lehmann. March 26th, 1932. (414457.)

9980. "Method and machine for electrically connecting the arms of the foot of knitting-machine needles and the like." G. Fuchs and H. Spath. April 3rd, 1933. (414467.)

11050. "Electric lampholders." H. Rottenburg. April 13th, 1933. (414472.)

11723. "Muting-devices for radio receiving sets." General Electric Co., Ltd., and C. N. Smyth. April 21st, 1933. (414474.)

12379. "Electrical apparatus for heating air." G. B. Burnside. April 28th, 1933. (414475.)

15757. "Electric discharge devices and cathode arrangements for use therein." Telefunken Ges. für Drahtlose Telegraphie. May 31st, 1932. (414488.)

15918. "Alternating-current power circuit-breakers." Akt.-Ges. Brown Boverie et Cie. June 1st, 1932. (Cognate application 15919/33.) (414491.)

17945. "Insulating of magneto-electric machines." J. Bohli. June 23rd, 1932. (414501.)

18276. "Automatic telephone and like selective systems." Siemens Bros. & Co., Ltd. D. P. Long and W. G. Patterson. June 27th, 1933. (414503.)

18665. "Multi-grid thermionic valves." G. Leibovici. June 30th, 1933. (414506.)

19065. "Arrangements for testing and adjusting selecting-switches for automatic telephone and like selective systems." Siemens Bros. & Co. and A. T. Humphries. July 5th, 1933. (414508.)

19495. "Control systems for electric discharge lamps." British Thomson-Houston Co., Ltd. July 9th, 1932. (414510.)

20009. "Electric immersion heaters." British Thomson-Houston Co., Ltd. July 14th, 1932. (414511.)

21160. "Electric connecting-devices of the plug-and-socket type." Callender's Cable & Construction Co., Ltd., and S. J. Bryce. July 27th, 1933. (414515.)

23602. "Manufacture of thermionic valves and the like." Marconi's Wireless Telegraph Co., Ltd. September 1st, 1932. (414523.)

23604. "Cooling systems for a vapour-electric discharge device and a transformer connected thereto." British Thomson-Houston Co., Ltd. August 24th, 1932. (414524.)

23843. "Electric bells and like devices." Siemens Bros. & Co., Ltd., and C. R. Riber. August 28th, 1933. (414526.)

24039. "Submarine cables." Norddeutsche Seekabelwerke Akt.-Ges. October 24th, 1932. (414528.)

24450. "Electric cable joints." Okonite-Callender Cable Co., Inc. September 2nd, 1932. (414530.)

24675. "Cable-handling means for electrically driven tractors." H. G. Kemp. September 6th, 1933. (414532.)

25617. "Electric fuses." British Thomson-Houston Co., Ltd. September 17th, 1932. (414534.)

28409. "Electric devices for warming or airing beds." J. W. Kitchener. October 14th, 1933. (414545.)

29368. "Leading-in insulators for metal-vapour rectifiers." English Electric Co., Ltd. October 22nd, 1932. (414550.)

29369. "Fixing of anode protection means in metal-vapour rectifiers." English Electric Co., Ltd. October 22nd, 1932. (414551.)

30144. "Cooling means for metal-vapour rectifiers." English Electric Co., Ltd. October 29th, 1932. (414552.)

30394. "Production of resistor elements of wire for electrical heating apparatus." J. T. Shevlin (Siemens-Schuckertwerke Akt.-Ges.). November 1st, 1933. (414553.)

33154. "Telephone plants for wireless transmission of communications." Telefonaktiebolaget L. M. Ericsson. July 7th, 1933. (414560.)

34196. "Electric circuit-controlling apparatus." British Thomson-Houston Co., Ltd. December 8th, 1932. (414563.)

35108. "Systems for the telephonic distribution of time and other signals." Soc. Anon. des Ateliers Brillié Frères. December 14th, 1932. (414568.)

36124. "X-ray apparatus." C. H. F. Müller Akt.-Ges. December 23rd, 1932. (414575.)

1934

1825. "Electric dry cells." E. P. Baumont. January 18th, 1933. (414582.)

3777. "Indication devices for broadcast receivers." Ideal Werke Akt.-Ges. für Drahtlose Telephonie. February 4th, 1933. (414416.)

4132. "Multiple variable condensers." R. Bosch Akt.-Ges. February 15th, 1933. (414588.)

5890. "Preparation of fluorescent screen substances for cathode-ray excitation." A. C. Cossor, Ltd. February 22nd, 1933. (414597.)

6208. "Remote control by wireless of unmanned signal stations." Naamlooze Vennootschap Machinerieen-En Apparaten Fabrieken. March 4th, 1933. (414600.)

6609. "Circuit arrangements for amplifying or producing high-frequency oscillations." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. March 11th, 1933. (414603.)

7674. "Electric discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 4th, 1933. (414608.)

8071. "Luminous sources formed by electric discharge tubes." General Electric Co., Ltd. March 15th, 1933. (414611.)

9410. "Multiple electric meter device for measuring current and voltage." Hartmann & Braun Akt.-Ges. July 24th, 1933. (414612.)

9599. "Hydro-electric steering-apparatus for ships." Etablissements P. Duclos and J. Duclos. March 27th, 1934. (414615.)

9605. "Kerr cells." Süddeutsche Telefon-Apparate, Kabel und Drahtwerke Akt.-Ges. Tekade. July 5th, 1933. (414616.)

10802. "Luminous electric discharge tubes." General Electric Co., Ltd. June 27th, 1933. (414620.)

11243. "Radio tube shields." Goat Radio Tube Parts, Inc. April 14th, 1933. (414623.)

11444. "Systems comprising one or more gas-filled discharge tubes supplied from a source of alternating current." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 22nd, 1933. (414624.)

12670. "Radio receivers." Telefunken Ges. für Drahtlose Telegraphie. May 9th, 1933. (414627.)

15994. "Mercury-arc devices." English Electric Co., Ltd. August 13th, 1933. (414630.)

18954. "Miners' and like safety lamps." E. A. Hailwood. November 28th, 1932. (Divided application on 414420.) (414418.)

18955. "Miners' and like safety lamps." E. A. Hailwood. November 28th, 1932. (Divided application on 414420.) (414385.)

18956. "Miners' and like safety lamps." E. A. Hailwood. November 28th, 1932. (Divided application 414420.) (414386.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 22nd.

VLC (lettering and design). No. 544576. Class 6. Electric generator test stands and parts thereof, &c. No. 544573. Class 8. Testing apparatus for electric coils and condensers, ammeters, &c. No. 544575. Class 13. Pole-expanding tools for dynamos and motors, &c.—V. L. Churchill & Co., Ltd., 27, Walnut Tree Walk, Kennington, S.E.11.

Cogent. No. 552508 and 552509. All goods in Classes 8 and 9. —Cogent Signals, Ltd., Faraday Works, St. Saviour's Road East, Leicester.

Ferranti. No. 549142. Class 8. Radio receiving sets, radio-gramophones, loud speakers, thermionic valves, electric measuring instruments, electric transformers, surge absorbers, accumulators, dry batteries, condensers, voltage regulators, wave traps, battery eliminators, testing apparatus, relays for protecting electric circuits, battery chargers, thermostatic switches for use in connection with electric storage water heaters, and parts thereof.—Ferranti, Ltd., Hollinwood, Lancs.

Belmont, Value, Quality (lettering and design). No. 549498. Class 8. Sound reproducing and recording apparatus and parts thereof, radio-telephone apparatus and radio-gramophones.—British Belmont Radio, Ltd., Balfour House, 119-125, Finsbury Pavement, E.C.2.

Mum. No. 550158. Class 8. Electrical condensers, resistances, transformers, tuning coils, chokes, valve holders, potentiometers, gramophone pick-ups, and loud speakers.—Graham Farish, Ltd., 153, Mason's Hill, Bromley, Kent.

Vidor. No. 551095. Class 8. Radio apparatus, gramophones, and batteries (not for medical purposes).—Vidor, Ltd., West Street, Erith, Kent.

Ozon. No. 552307. Class 13. Electric lamps (ordinary).—Vereenig de Industrieen Rotterdam V/H Ph. Verhagen & Zoonen, Rotterdam, Holland. (British representatives: Wm. Brook & Son, 1, Quality Court, Chancery Lane, W.C.2.)

BG (lettering and design). No. 548077. Class 50. Bell rosettes, ceiling roses, rings for flush switches, bells and buzzers, and insulating parts of bells, transformers, pushes, plugs, sockets, plug tops, switches and switch plugs, all being fittings made principally of synthetic resin.—British General Manufacturing Co., Ltd., Tyrwhitt Road, Brockley, Kent.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alford.—Extensions, including an X-ray department, for the War Memorial Cottage Hospital Board of Management.

Andover.—Extensions, including ward block, War Memorial Hospital (£4,028); W. E. Chivers & Sons, Ltd., builders, Devizes.

Ansley (WARWICKSHIRE).—Houses, Ansley Village; Z. A. Brown.

Ascot.—Enlargement of Heatherwood Hospital; L.C.C. architect.

Birmingham.—Additional chemical block, Edgbaston (£45,000), for Birmingham University. Houses (319), Broad Meadow Estate, Kings Norton; H. H. Humphries, city surveyor, Council House. Cinema, Kingston Hill, Coventry Road (£30,000); Whittall & Son, builders, Lancaster Street. Garage, offices, &c., Coventry Road, for G. Taylor (£6,000); W. C. Skinner, builders, 316, Birchfield Road.

Blackburn.—Mission Hall, Regent Street (electrical work); W. E. L. Crumblehulme, architect, 25, Richmond Terrace.

Blackpool.—Hotel on the Cliffs at North Shore (electrical work); I. Massie, architect, 14, Queen Street.

Bognor Regis.—Block of shops, Craigwell Estate, Barrack Lane, Aldwick; J. Auty, architect, 44, South Street, Chichester.

Bolton.—Alterations to "Rawsons Arms" Hotel, Peel Street, Farnworth, and "Wellington" Inn, Westhoughton, for Threlfall's Brewery Co., Ltd. (electrical work); B. Waterhouse, architect, Brewery Offices, Cooke Street, Salford.

Bradford.—Houses (22), Aireville Road, Frizinghall; John Chippendale, builder, 260, Bradford Road, Frizinghall. Houses (100), Reevy Avenue, Wibsey; Chippendale and Needham, 18, Hawes Mount, Little Horton.

Brierley Hill.—Houses (88), Mount Estate; R. H. J. Comber, U.D.C. surveyor.

Brondesbury.—Extensions to Mission House, Brondesbury Park; Catholic Missionary Society.

Burnley.—Five years' housing programme (1,600); borough surveyor.

Canterbury.—Hospital, electrical and heating work; C. Burns, architect, Stone Lodge, Vale Avenue, Tunbridge Wells.

Cardiff.—Factory, Sanatorium Road; Concordia Electric Safety Lamp Co., Ltd.

Cheadle.—Alterations to Red Lion Hotel, Stockport Road, for Threlfall's Brewery Co., Ltd. (electrical work); B. Waterhouse, resident architect, Brewery Offices. Shopping centre, for Outwood Hall Estates, Ltd.; J. L. Edwards, architect.

Chepstow.—Houses (50), St. Tecla site, Bulwark for U.D.C.

Chester.—Primary school, Stanton Road, Bebington; F. Anstead Brown, county architect, the Castle.

Chorley.—Mental Defectives Home, Lisieux Hall, for Catholic Diocesan Authorities (electrical work); G. & J. Seddon, Ltd., builders, 5, Manchester Road, West, Little Hulton.

Consett.—Houses (78), for the U.D.C.; J. J. Eltringham, architect, Derwent Street, Blackhill.

Crayford.—Houses (225); U.D.C. surveyor.

Depwade.—Cottages (54) for R.D.C.; F. H. Bowden, surveyor, Long Stratton.

Dodworth.—Alterations to the Church, installation of new organ; Sir Charles Nicholson, architect, New Square, Lincoln's Inn, London.

Droylsden.—Two storey extension to the works of J. Robertson & Sons; W. H. George & Sons, architects, 7, Warrington Street, Ashton-under-Lyne.

Dumfries.—Public abattoir (£18,500), electrical work; D. Flett, architect, 17, Buccleuch Street.

East Riding.—Mental hospital, extensions, Brandesburton (£19,759); county architect.

Eccles.—Alterations to "White Horse" Hotel, Gildabrook Road, for Frederic Robinson, Ltd. (electrical work); A. Guest, resident architect.

Edinburgh.—Houses (82), Glendevon Gardens, &c.; C. E. Tweedie & Sons, architects, 54, Frederick Street. Houses (56) and shops, Parkgrove, Queensferry Road, Barnton; J. A. W. Grant, architect, 25, Rutland Square.

Glasgow.—New housing schemes (£1,224,410); housing director. Extensions, Crookston Institution and Southern Hospital (£41,000); city engineer.

Hazel Grove (STOCKPORT).—Country club, café, &c.; Buxton Road; T. A. Fitton & Sons, architects, Corporation Street, Manchester.

Heckmondwike.—Houses (26), Hill Top Estate; U.D.C. surveyor.

Hemsworth.—Houses (50); R.D.C. surveyor.

Hitchin.—Extensions, North Hertfordshire and South Bedfordshire Hospital (£25,000); secretary.

Huddersfield.—Houses (156), Alder Street; borough engineer.

Hull.—Remand Home, Maybury Road; city architect.

Leicester.—Municipal abattoir (£178,000); Corporation Markets Committee.

Liverpool.—Houses (700), Bowring Park (£500,000); Unit Construction Company. Office and sanitary block in Chisendale Street, for Tate & Lyle, Ltd., Exchange Buildings.

London.—(BARKING).—Extensions, Barking Hospital, Upney Lane; H. H. Dawson and H. W. Allardyce, architects, Clock House Chambers. (CHELSEA).—Re-housing, Manor Street (£18,595); borough engineer. (EALING).—Development of the Bays Estate; R. Schaufelberg, architect. Development of Brent Valley Estate; Hilbery Chaplin, Ltd. (HACKNEY).—Dwellings, Duncan Square (£52,000); L.C.C. architect. (LEYTON).—Domestic and practical subjects centre, Trumpington Road, for the borough Electricity Committee; J. H. Jacques, architect, 61, West Ham Lane, Stratford, E. (S.E.1).—Block of flats, Kennington Road; Parnacott & Co., 93, York Road, S.E.1. (SHOREDITCH).—Reconstruction of Oakford Place (£28,500); L.C.C. architect. (WILLESDEN).—Bakery extensions, Waxlow Road; McVitie & Price, Ltd. Factory, Cumberland Avenue; Associated Agricultural Processes, Ltd. Houses (40), Vincent Crescent; T. W. Heath, Ltd. Houses (226), various sites; borough engineer. Open air baths, Craven Park (£20,057); G. Percy Trentham, Ltd. Town Hall; borough engineer.

Loughborough.—Extension of works for Genatosan, Ltd.; A. E. King & Co., architects, 19, Baxtergate.

Manchester.—Additions to works of the Hanover Mill Co., London Road; Pendleton & Dickinson, architects, 16, Brazennose Street. Hotel for Walker & Homfray, Ltd.; E. J. Coupe & Sons, builders, Springfield Road, Salford. Reconstruction of the Bijou Cinema, Irskine Street, Hulme, into a market hall for A. L. Ward; W. Cheetham, architect, Church Street, Didsbury.

Merthyr Tydfil.—Houses, Galon Uchaf (62), and Heolgerrig (46); borough surveyor.

Monmouthshire.—School, Park Street, Blaenavon; J. Bain, County Hall, Newport.

Newport (MON).—Rebuilding and enlarging the St. Michael Schools; R.C. Authorities. Reconstruction of Holy Cross Schools; R.C. Authorities.

Northallerton.—Houses (81); U.D.C. surveyor.

Oxford.—Shops, offices and flats, Woodstock Road and St. John's Road; St. John Baptist College trustees.

Peebles.—County Buildings (£20,000); county clerk.

Peterborough.—Council schools, Folbridge Road (£17,500); Thos. Ellington & Son, builders. Memorial Church Hall (£5,000) for Church of St. Teresa of Lisieux; H. & L. Cave, builders, Wisbech Road, Thorney.

Ramsbottom.—Houses (34); A. Plunkett, engineer and surveyor, U.D.C. offices.

Reading.—Block, Caversham Council School, Harley Road; W. R. Morris, architect, 1, Market Place.

Rotherham.—Church for Parochial Church Council of the Whiston Parish Church; W. G. Robson, Ltd., builders, Bamforth Street, Works, Sheffield. Houses (130); R.D.C. surveyor. Pithead baths at the Markham Colliery, Armethorpe; J. H. Forshaw, architect, Mines Section, Romney House, Marsham Street, London.

Rye.—Houses (35), New Road; A. G. J. Cornner, borough surveyor, 107, High Street.

St. Helens.—Cinema, Bridge Street, for the Savoy Pictures House, Ltd.; George E. Tonge, Southport.

Sale.—Church and Sunday School, Glebelands Road, for the Trustees of the Independent Methodist Church; Moore & Son, builders, Booth Road.

Sanderstead.—Houses (26), Bordwood Close; H. N. Dering. Houses (30), Purley Oaks Road; Thomas & Son. Houses (30), Sanderstead Court; C. H. G. Taylor.

Scarborough.—Houses (180), Sandybed Lane Estate, for F. W. Plaxton, builder, Castle Works; Jones & Rickaby, architects, 102, Westborough.

Sheffield.—University Hall of Residence (£38,000), Clarkehouse Road, for the Council of the University of Sheffield; G. Longden & Sons, Ltd., builder, Parkwood Road Works.

Smethwick.—Branch library (£5,500); borough engineer.

South Molton.—Cinema, East Street; J. P. Dixon, architect, Tiverton.

Staines.—Improvements to Poor Law Institution (£9,000); Middlesex county architect.

Stirling.—Houses (33); burgh surveyor.

Stockport.—Cinema and shops, for C. Greenhalgh of Bournemouth; G. Clayton, architect, 4, Wellington Street. School, Garners Lane, for the borough E.C.; A. Lawton, director of education.

Stockton-on-Tees.—Houses (104), Wolviston Road; R. Thornton & Sons, builders, Midland Bank Chambers, South Shields.

Streatley.—Houses (164), Bramingham Road, for E. & G. C., Ltd.

Stroud.—Cinema for H. E. Weight, 35, Plymouth Road, Penarth, Glam.

Sunderland.—Houses (186), Ford Estate, for the T.C.; T. P. Collinge, borough engineer.

Surrey.—Three schools, for the County Education Committee; secretary, Kingston-on-Thames.

Tarporley (CHESHIRE).—Houses (24); U.D.C. surveyor.

Tenbury.—Extensions at the Tenbury Wells Hospital (£3,500), for the Board of Management of the Tenbury and District Hospital and Nursing Association; Hewitt & Son, builders.

Wakefield.—Houses, Horbury Road Estate (60), Lupset Estate (20), Eastmoor Estate (15), Oakenshaw Street (12), and Thornes Road (24); P. Morris, architect, Town Hall.

Walsall.—Warehouse and extensions to bakery, Shaw Street, for the Walsall & District Co-operative Society, Ltd.; Deacon & Boardman, Ltd., builders, Algernon Street.

Warwickshire.—Various building schemes (£146,440); county architect.

Wembley.—Library (£5,000), Forty Lane; U.D.C. surveyor.

Westmorland.—County offices, Stricklandgate, for the C.C.; clerk, Lowther Street.

West Riding.—Senior schools, South Hiendley, for the County E.C.; education architect, Wakefield.

West Suffolk.—Practical instruction centre, Hadleigh Council School; county architect.

Wirksworth (DERBY).—Houses (22), Gorsey Bank; U.D.C. architect, Town Hall.

Woburn Sands.—Enlargement of Edgbury Convalescent Home (£6,400); Middlesex county architect.

Wolverhampton.—Extensions to buildings for Building Committee of Red Cross Street Sunday School; R. Speake & Sons, builders, Stafford Street.

Wrexham.—Drill Hall, Llay (£4,197), for the Denbighshire Territorial Army Association; W. J. Humphreys, Ltd., builders, Acrefair, Ruabon.